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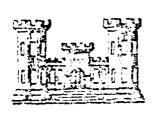


MERRIMACK RIVER BASIN ALTON, NEW HAMPSHIRE

ALTON POWER DAM NH 00011

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM





DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS, 02154

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JANUARY 1980

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Merrimack River Basin Alton, New Hampshire Merrymeeting River

20. ABSTRACT (Continue on reverse side if necessary and identify by black mamber)

The dam consists of a concrete gravity spillway and outlet works with an earth embankment at the left end. The dam is about 190 ft. long and its height is 16 ft. The dam is in fair condition. It is intermediate in size with a high hazard potential.

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MERRIMACK RIVER BASIN ALTON, NEW HAMPSHIRE

ALTON POWER DAM NH 00011

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JANUARY 1980

NATIONAL DAM INSPECTION PROGRAM PHASE I INVESTIGATION REPORT

Identification No.: NH 00011
Name of Dam: Alton Power

Town: Alton

County and State: Belknap, New Hampshire Stream: Merrymeeting River

Date of Site Visit: 1-2 November 1979

BRIEF ASSESSMENT

Alton Power Dam consists of a concrete gravity spillway and outlet works with an earth embankment at the left end. The spillway has twelve stoplog-controlled bays. The outlet works is a sluice gate intake connected to a short section of steel penstock. A footbridge, allowing access to the stoplogs, runs above the spillway and forms the top of the dam. The overall length of Alton Power Dam, including the earth embankment, is approximately 190 ft. and its height is about 16 ft. The dam was completed in 1923 for private hydroelectric power deneration.

Due to the extent of downstream development that would be affected in the event the dam were to fail, Alton Power Dam is confirmed as having a "high" hazard potential in accordance with Corps of Engineers Guidelines.

The dam is in fair condition, based on a visual examination of the structure. Although some deficiencies were noted, there was no evidence of settlement, lateral movement or signs of structural failure, or other conditions which would warrant urgent remedial action.

Based on the "intermediate" size and "high" hazard potential classifications in accordance with Corps of Engineers guidelines, the test flood for this dam is the Probable Maximum Flood (PMF). Hydraulic analyses indicate that the routed test flood outflow of 10,200 cfs (inflow 12,900 cfs or 550 csm) would overtop the dam by about 4.5 ft. assuming 2.8 ft. of stoplogs in place. With the water level at the top of the dam, the spillway capacity with stoplogs in place is approximately 1,410 cfs, which is 14 percent of the routed test flood outflow. With all stoplogs removed, the routed test flood outflow is about 9,700 cfs and the spillway capacity at top of dam is about 3,730 cfs, or 38 percent of the routed test flood outflow.

The State of New Hampshire Fish and Game Department,

owner of the dam, should conduct the following investigations under the direction of a registered professional engineer: 1) perform a detailed hydraulic/hydrologic investigation to determine the need and means of increasing the discharge capacity of this facility, 2) determine the nature of the observed seepage and its effect on the stability of the left embankment, 3) inspect the spillway during a period of low flow to assess its structural condition, and 4) determine the required work to insure the operability of the outlet works and make the penstock supports structurally adequate, as outlined in Section 7.2.

Any necessary modifications resulting from the investigations, and remedial measures, including clearing brush and trees from the embankments, repairing spalled areas of concrete, repairing the timber stoplog supports and monitoring of seepage on the left downstream side, as outlined in Section 7.3, should be implemented by the Owner within one year after receipt of this report. The owner should also prepare a formal operations and maintenance manual for the dam and establish an emergency preparedness plan and downstream warning system that would compliment the State's existing disaster operations plan, "Link-Up".

> HARL ALDRICH, 押 7634

HALEY & ALDRICH, INC. by:

Harl Aldrich

President

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the office of Chief of Engineers, Washington, DC 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm run-off), or a fraction thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential. Consideration of downstream flooding other than in the event of a dam failure is beyond the scope of this investigation.

The Phase I Investigation does <u>not</u> include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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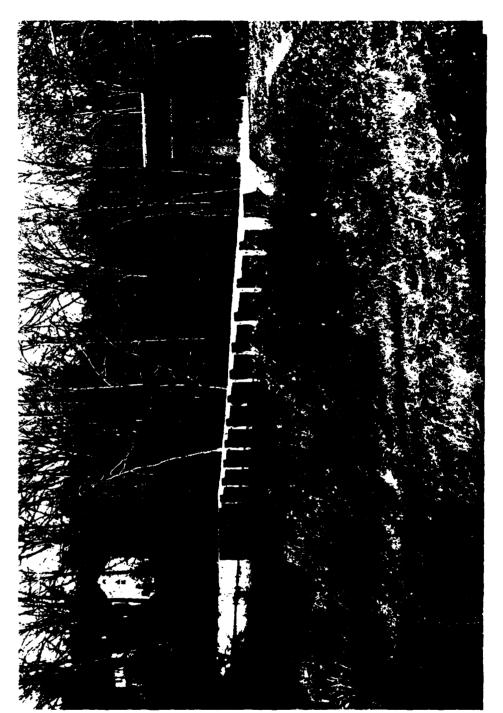
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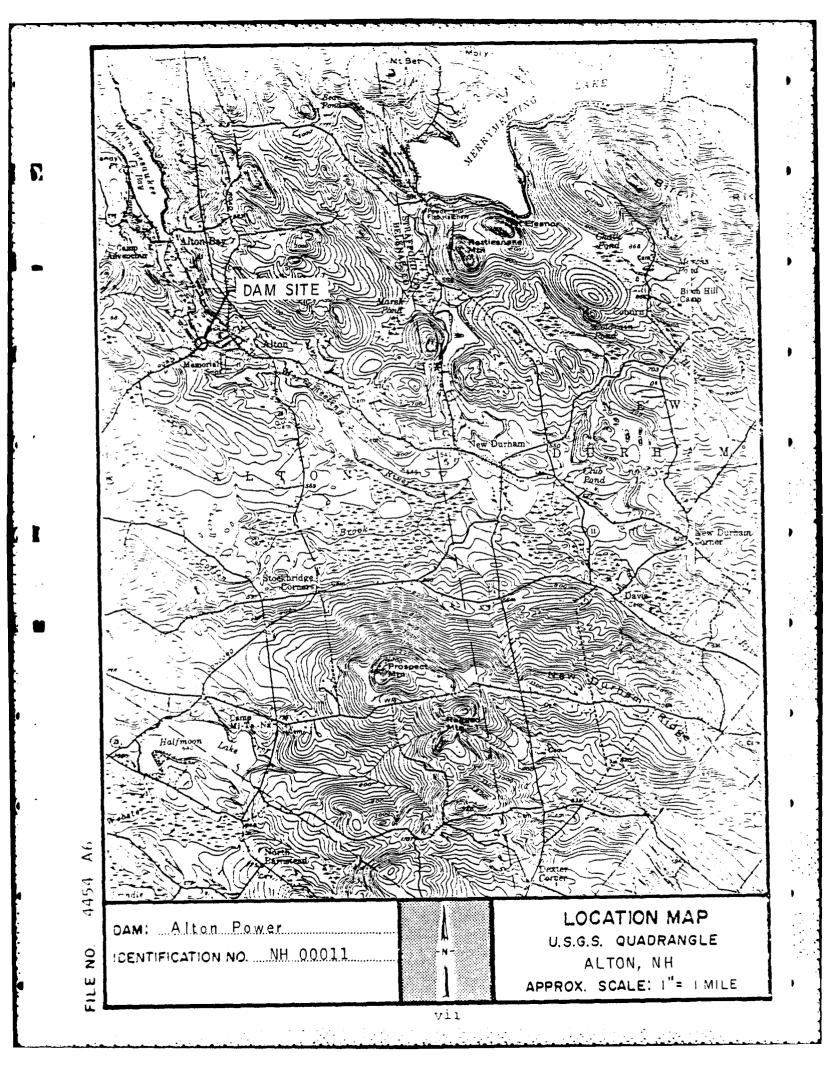
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Overview of Alton Power Dam showing upstream side



PHASE I INVESTIGATION REPORT NATIONAL DAM INSPECTION PROGRAM

ALTON POWER DAM NH 00011

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

Haley & Aldrich, Inc. has been retained by the New England Division to inspect and report on selected dams in the States of New Hampshire and Maine. Authorization and notice to proceed were issued to Haley & Aldrich, Inc. under a letter dated 31 October 1979 from Colonel William E. Hodgson, Jr., Corps of Engineers. Contract No. DACW33-80-C-0009 has been assigned by the Corps of Engineers for this work. Camp, Dresser & McKee, Inc. was retained as consultant to Haley & Aldrich, Inc. on the structural, mechanical/electrical and hydraulic/hydrologic aspects of the Investigation.

- b. Purpose of Inspection. The primary purposes of the National Dam Inspection Program are to:
- 1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
- 2. Encourage and prepare the states to initiate effective dam safety programs for non-Federal dams.
- 3. Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. The dam is located at the northwestern end of Wentworth Pond in Alton, New Hampshire, as shown on the Location Map, page vii. The latitude and longitude of

the dam site are N43^o27.3' and W71^o13.8', respectively. Spill-way discharge is conveyed by Merrymeeting River approximately one mile to Alton Bay at the southern end of Lake Winnipesaukee.

b. Description of Dam and Appurtenances. Alton Power Dam consists of a concrete gravity spillway and outlet works with an earth embankment at the left end. The spillway is 81.8 ft. long with twelve stoplog-controlled bays. The outlet works is located at the right end of the spillway and consists of a sluice gate intake connected to a short section of 5 ft. nominal diameter steel penstock. The earth embankment at the left end is well-defined and was designed to be approximately 65 ft. long. A short embankment at the right end is ill-defined and will be referred to as the right abutment.

A footbridge, allowing access to the stoplogs, runs 6 ft. above the permanent spillway crest and forms the top of the dam. The overall length of Alton Power Dam, including earth embankments, is approximately 190 ft. and its height is about 16 ft. As recorded in prior State of New Hampshire inspection reports, the distance from the left end of the left headwall to the distant end of the right headwall is approximately 136 ft. The dam was built over an old dry-laid stone masonry dam that previously occupied the site.

The spillway has an ogee shape. Stoplogs are used to maintain the level of Wentworth Pond at approximately 3 ft. above the permanent crest of the spillway during normal flow. Downstream beyond the toe of the spillway, stone has been placed to prevent erosion.

The outlet works, and penstock were originally used to conduct water to a downstream power station. Since the power generating capabilities of the dam were abandoned in 1958, the wooden portion of the penstock has been disassembled and the only present use of the outlet works is as a reservoir drain. The gate lift mechanism for the outlet works is housed in a wooden gatehouse.

Alton Power Dam was designed to have a concrete cutoff or core wall starting 16 ft. into the right abutment, running along the upstream side of the dam and ending at the left training wall. Positive cutoff beyond the left training wall was intended to be achieved by facing the old dry-laid stone with a minimum of 12 in. of concrete and carrying this facing down to impervious soil. This concrete facing forms a headwall, 30 ft. in length, along the upstream side of the left embankment.

- c. Size Classification. The storage at the top of Alton Power Dam is estimated to be 4,760 acre-ft. and the corresponding hydraulic height of the dam is approximately 16 ft. Storage of from 1,000 to 50,000 acre-ft. and/or a height of from 40 to 100 ft. classifies a dam in the "intermediate" size category, according to the guidelines established by the Corps of Engineers. Although the height of this dam is much less than 40 ft., it is classified as an "intermediate" size dam by virtue of its storage capacity.
- d. Hazard Classification. The dam is currently classified as having a "high" hazard potential in the Corps of Engineers National Inventory of Dams. Dam failure analysis computations in Appendix D, which are based on "Guidance for Estimating Downstream Dam Failure Hydrographs", confirm this classification. Analyses indicated that a failure of the Alton Power Dam would effect in excess of 20 residential homes, a motel and a marina. The potential loss of life would be more than a few.
- e. Ownership. The name, address and phone number of the current owner of Alton Power Dam are:

State of New Hampshire Fish and Game Department Box 2003 34 Bridge Street Concord, New Hampshire 03301 Phone (603) 271-3421

The original owner of the dam, George H. Jones, sold it and all deeded rights to the Public Service Company of Manchester, New Hampshire, on 15 January 1946. On 20 October 1958, the State of New Hampshire, Fish and Game Department, became owner of the dam and has maintained and operated the structure since that time.

- f. Operator. Mr. Franklin Alden, Hatchery Superintendent at the Powder Mill Rearing Station of the Fish and Game Department, has been responsible for the operation maintenance and safety of the dam since 1970. His phone number is (603) 859-2043.
- g. Purpose of Dam. The Alton Power Dam was originally constructed for hydroelectric power generation. The power generating facilities were abandoned in May 1958 and the present functions of the dam are primarily to provide a waterfowl habitat, watershed protection and flood control.

h. Design and Construction History. The present dam was designed from 1921 to 1923 by I.W. Jones & Co. of Milton, New Hampshire for George H. Jones of New Durham, New Hampshire. Relevant portions of the design information in the form of three drawings by I.W. Jones & Co. are included in Appendix B.

The construction of Alton Power Dam is believed to have been completed in 1923. The powerhouse, penstock and associated works were completed in 1925, the first year the facility generated electricity. The name of the construction contractor is unknown but a copy of the original Specifications and Contract is on file at the State of New Hampshire Water Resources Board.

In 1959, the engineering and maintenance division of the Fish and Game Department rehabilitated the deteriorated concrete portions of the dam. Additional work has been performed as needed over the years. Most recently, the concrete on the footbridge was patched and the stoplogs were replaced on 22 April 1979.

i. Normal Operational Procedures. There is no formal written procedure for the operation of the dam. The dam is visited once a week and debris is removed from the upstream face of the spillway when observed. Approximately 2.8 ft. of stoplogs are normally kept in each of the 12 spillway bays except during the winter when approximately 1.25 ft. of stoplogs (two boards) are removed from the bays at either end. When the river stage rises to about 6 in. above the top of stoplogs, local flooding occurs which prompts residents to telephone the dam operator who in turn removes some stoplogs. Repairs to the dam are made on an as-needed basis.

1.3 Pertinent Data

All elevations reported herein are based on or were measured relative to a USGS permanent spillway crest elevation given in a New Hampshire Water Resources Board, Inventory of Dams and Water Power Developments report dated 22 July 1935. By comparison with information given on the USGS Alton Quadrangle Map, it appears reasonable to assume the given elevation is correct and that the elevations presented in this report are based on National Geodetic Vertical Datum (NGVD).

a. Drainage Area. The drainage area tributary to Alton Power Dam is 34.5 square miles. Merrymeeting Lake, which is located in the upper portion of the watershed, has a tributary drainage area of 11 sq. mi. to Merrymeeting Lake Dam, which forms the lake. The remaining portion of the watershed downstream of Merrymeeting Lake is heavily forested and sparsely developed. A significant portion of the lower watershed is marsh lands drained by Coffin Brook.

b. Discharge at Dam Site

| 1) | Outlet works | 400 cfs at El. 526.1 (top of stoplogs) |
|----|--|--|
| 2) | Maximum known flood at dam site | |
| 3) | Ungated spillway capacity at top of dam (without stop- | Olikilowii |
| | logs)(with stoplogs) | |
| 4) | Ungated spillway capacity at test flood pool elevation | 1,410 CIS |
| | (without stoplogs) | |
| 5) | (with stoplogs) | • |
| 6) | normal pool elevation Gated spillway capacity at | Not applicable |
| | test flood pool elevation | Not applicable |
| 7) | Total project capacity at test flood pool elevation | |
| | (with stoplogs removed) | 9,700 cfs at El. 532.6 |
| 8) | Total project discharge at test flood pool elevation | |
| | (with stoplogs in place) | 10,200 cfs at El. 533.8 |

c. Elevation (ft. above NGVD)

| 1) | Streambed at centerline of | |
|----|----------------------------|----------------|
| | dam | 513.3 |
| 2) | Test flood tailwater | |
| 3) | Upstream portal invert | |
| | diversion tunnel | Not applicable |
| 4) | Normal pool | |
| 5) | Full flood control pool | |
| 6) | Spillway crest | |
| | (without stoplogs) | 523.3 |
| | (with stoplogs) | |
| 7) | Design surcharge-original | |
| | design | Unknown |
| 8) | Top of dam | 529.3 |
| 9) | Test flood surcharge | |
| | (without stoplogs) | 532.6 |

(with stoplogs)..... 533.8

| d. | Res | ervoir Area (acre-ft.) | |
|----|----------------------------|---|--|
| | 1) 2) 3) | Length of test flood pool Length of normal pool Length of flood control pool | 3.9 mi. (Est.) |
| e. | Sto | rage (acre-ft.) | |
| | 1) 2) 3) 4) 5) | Spillway crest | Not applicable 1,120 4,670 6,720 |
| f. | Res | ervoir Surface (acres) | |
| | 1) 2) 3) 4) 5) | Spillway crest | Not applicable 230 984 |
| g. | Dam | | |
| | 1) | Type | Concrete gravity spillway with earth embankment at left end |
| | 2) 3) 4) 5) | Crest length Height Top width of embankment Side slopes | 16 ft. Approx. 8 ft. Embankment slopes not well defined; designed 1-1/2H |
| | 6) 7) | Zoning Impervious core | Designed 16 ft. into right abutment and along front of left embankment to imper- |
| | 8) | Cutoff | vious soil Concrete cutoff wall to impervious soil designed at front of dam |
| | 9) 10) | | None |
| h. | Div | ersion and Regulating Tunnel. | Not applicable |

i. Spillway

| 1) | Type | Concrete ogee with 12 bays separated by 1-ft. wide concrete piers |
|----|--------------------------|---|
| 2) | Total length of weir | 81.8 ft. |
| 3) | Effective length of weir | |
| 4) | Crest elevation | |
| 5) | Gates | None (stoplogs are kept at a maximum of 2.8 ft. in heigth) |
| 6) | U/S channel | |
| 7) | D/S channel | Merrymeeting River to Lake Winnipesaukee, |
| 8) | General | approximately one mile Spillway crest approx. 19 ft. above normal level of Lake Winni- |
| | | pesaukee |

j. Regulating Outlets. The outlet works for the Alton Power Dam consist of a manually operated wooden sluice gate followed by a 6-ft. to 5-ft. reducer and a short section of 5-ft. nominal diameter steel penstock. The sluice gate was last operated in 1972. The invert elevation of the penstock is El. 516.7. The present outlet works once served as a fore-bay with debris rack for an approximately 250-ft. long wooden penstock which conveyed water to a generating facility located on the ri at downstream bank of the river. The penstock and generating facility have long been abandoned and the outlet works now discharges directly to the downstream river channel.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

A copy of the original specifications and contract document prepared by I.W. Jones & Co. dated 16 July 1922 and blue print copies of design drawings are on file at the State of New Hampshire Water Resources Board.

A review of the specifications indicates that attention was given primarily to the requirements for constructing the concrete work. Embankments at either end were proposed to be thoroughly compacted and have side slopes of 1.5 horizontal to 1 vertical with no other particular considerations for stability.

The above documents and a copy of a letter submitted by I.W. Jones & Co. to the Public Service Commission of New Hampshire dated 7 August 1923 for their approval to build the dam, comprises all the available design information known to exist.

2.2 Construction Data

No as-built data or records of the construction of the dam were located and none are believed to exist.

2.3 Operation Data

No operational data on the dam were located other than the conditions reported in prior inspection reports dating back to 1935.

2.4 Evaluation of Data

- a. Availability. A list of the engineering data available for use in preparing this report is included on page B-1. Selected documents from the listing are also included in Appendix B.
- b. Adequacy. There was a sufficient amount of engineering data available to aid in the evaluation of Alton Power Dam. A review of these data in combination with visual examination, preliminary hydraulic and hydrologic computations, consideration of past performance and application

of engineering judgement, was adequate for the purposes of a Phase I assessment.

c. Validity. The information contained in the engineering data may generally be considered valid. However, details on the drawings are shown as designed and may vary slightly from those actually built. For example, the debris rack was not present over the outlet works intake, the shape of the headwall on the left side of the outlet works and the spillway length were found not to be as shown on prints of the original design. The as-built depths and configurations of the dam cutoff walls are unknown.

SECTION 3 - VISUAL EXAMINATION

3.1 Findings

a. General. The Phase I visual examination of the Alton Power Dam was conducted on 1-2 November 1979.

The upstream water surface elevation was about 3.1 ft. below the top of the dam on both days with water flowing over the stoplogs and spillway. On 2 November 1979, Mr. Frank Alden of the Fish and Game Department attempted unsuccessfully to operate the outlet works gate lift mechanism.

In general, the project was found to be in fair condition. Several deficiencies which require correction were noted.

A visual inspection check list is included in Appendix A and selected photographs of the project are given in Appendix A. The "Site Plan Sketch", page C-1, shows the direction of view for each photograph.

b. Dam. The concrete spillway of Alton Power Dam appeared to be in good condition. However, flow over the structure precluded its close examination, Photo No. 2. The alignment of the visual portions of the spillway and the footbridge over the spillway did not indicate evidence of major lateral movement or unusual settlement, Photo No. 3. The concrete training walls at either end of the spillway appeared to be sound with no major deficiencies observed.

There was no visual indication of significant settlement or movement of the earth embankment at the left end. However, at the right abutment, some erosion along a small path and an apparent cobble-concrete repair were observed adjacent to the outlet works, Photo No. 4. The erosion is minor but the repair is of poor quality with several large voids evident. Somewhat visible in Photo No. 5 are boulders that formed a foundation, on the downstream side of the right abutment, that predates the dam. Overall, the right abutment is considered to be in generall satisfactory condition.

The top of the left embankment is covered with small

saplings and a number of trees up to 8 in. in diameter Along the upper portion of the left downstream slope are several large oaks, birch and small maple trees. A difference in grade was observed between the top downstream surface of the left training wall and the adjacent embankment, Photo No. 6. The embankment might have been constructed this way or the difference may be caused by natural settlement of the embankment due to insufficient compaction effort during its construction. Some minor erosion was also apparent along the downstream side and adjacent to the left training wall.

There was considerable seepage at the base of the old dry-laid stone wall located along the left side of the downstream channel, Photo No. 7. Seepage was also evident from 3 to 6 in. above the water level in the area left and downstream of the spillway left training wall, Photo No. 8. The water was clear. According to Mr. Franklin Alden, the seepage condition has been present for at least 20 years, although prior inspection reports, Appendix B, do not mention seepage

Several areas of cobbles and numerous large boulders, up to a cubic yard in size, were observed on the downstream slope of the left embankment. The locations of the areas of seepage and stone are shown on the "Site Plan Sketch", page C-1.

c. Appurtenant Structures. There is a concrete foot-bridge with railing constructed over the crest of the spill-way on concrete piers that form the 12 stoplog bays. The footbridge is in good condition with numerous sections of recent patchwork evident. The railing is sound but with corrosion apparent.

The condition of the individual stoplogs was obscurred by the flow of water. However, the Dam Operator stated during the site examination that the stoplogs had been replaced on 22 April 1979. The wooden restraints forming the tracks in which the stoplogs are placed were deteriorated in the vicinity of the water line and did not appear to be in good condition, Photo No. 9. The support at the centerline of the spillway, located between bays 6 and 7, was partially rotted and damaged to such a degree as to place its serviceability in question.

The outlet works is in good condition with the exception of the discharge conduit or penstock. There is some spalling

of the concrete at the outlet works intake headwalls, Photo No. 10, and cracking of the concrete at the downstream face of the outlet works. The section of steel penstock is about 33 ft. long and, though rusted, appears serviceable. However, concrete U-shaped footings located under the penstock have shifted and become displaced with time as shown in Photo No. 11. In turn, the footings give little or no support to the penstock.

The gate lift mechanism, Photo No. 12, is enclosed by a wooden gate house which is also used to store spare stoplogs. Overall, the gate house was found to be in good condition as shown in Photo No. 13. However, the outlet works gate lift mechanism, when tried, could not be operated during the site examination. The Dam Operator reported that the gate was last opened sometime in 1972. The debris rack, originally located in front of the intake, has been removed at some unknown time.

d. Reservoir Area. The impounded portion of Merry-meeting River is bordered mainly by forested rolling terrain with the exception of within one mile of the dam. This portion has shoreline development subject to flooding during high reservoir stages. The impoundment immediately upstream of the dam is known locally as Wentworth Pond. The reservoir area is crossed by two bridges which could exercise a degree of hydraulic control during flood flows. Although the dam is considered a run-of-the-river dam, the four mile length of the upstream pool results in the availability of substantial storage.

There is no significant probability of landslides into the reservoir affecting the safety of the dam. Sedimentation has occurred behind the spillway to the degree that sediment is present in some areas to the top upstream edge of the weir. Little siltation has occurred in the outlet works intake channel.

e. <u>Downstream Channel</u>. Discharge from the spillway is carried by Merrymeeting River about one mile to Alton Bay at the southern end of Lake Winnipesaukee. Stone has been placed immediately downstream of the spillway apron and stone exists on the banks and in the channel providing protection against scouring during normal flows. The initial channel slope as it leaves the dam is approximately 0.003.

Existing development along the river in the vicinity of the dam is sparse. However, approximately 1,500 ft. upstream of its confluence with Alton Bay, extensive residential development is present along the banks of the river.

3.2 Evaluation

The masonry portions of the Alton Power Dam appear to be in good condition and performing satisfactorily at the present time with the exception of the outlet works. The outlet works, which provides the only means of draining the reservoir, needs attention to ensure its operability. The steel penstock is in serviceable condition. The concrete supports for the penstock have been damaged and displaced to the point where their structural adequacy is in doubt. The seepage observed downstream of the left embankment warrants further investigation and monitoring.

Based on the visual examination conducted on 1-2 November 1979, the Alton Power Dam is considered to be in fair condition. The remedial measures outlined in Section 7.3 should be implemented to correct the noted deficiencies in the outlet works and left dam embankment.

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

- a. General. In general, there are no formal procedures for the operation of the dam. Approximately 2.8 ft. of stoplogs are normally kept in each of the 12 spillway bays except during the winter when approximately 1.25 ft. of stoplogs (2 boards) are removed from the bays at both ends. Some stoplogs are reportedly removed when the river stage rises to about 6 in. above the top of stoplogs.
- b. Description of any Warning System in Effect. There is no specific warning system or emergency preparedness plan in effect for this structure. However, the Owner, the New Hampshire Fish and Game Department, is within the framework of the operations plan "Link-Up", an inter-agency plan in the State of New Hampshire for natural and man-made disaster operations. The plan establishes the procedure for notifying and calling upon the resources of other state agencies in times of emergency.

4.2 Maintenance Procedures

- a. General. There are no established formal procedures or manuals for inspection and maintenance of the dam. Remedial measures such as the replacement of stoplogs is reportedly performed on an as-needed basis.
- b. Operating Facilities. The spillway structure appears to have received regular maintenance. The facility is visited once a week and debris is removed from the upstream face of the spillway when observed. A number of spare stoplogs are kept in the gate house. There is no formal plan to maintain the outlet works control gate. The drain was reportedly last opened in 1972. An unsuccessful attempt was made to operate the gate during the site inspection.

4.3 Evaluation

Maintenance of the facility is being performed on the basis of need. There is currently no formal operational procedures in effect for Alton Power Dam. Formal operational procedures and maintenance programs should be established. A detailed emergency preparedness plan and warning system should be established for the specific dam to compliment the existing operations plan "Link-Up".

5.1 General

The Alton Power Dam is a run-of-the-river dam approximately 190 ft. in length with a concrete ogee spillway having an effective crest length of 70.5 ft. The spillway consists of 12 bays having the following widths: right bay 5 ft. 7 in., left bay 4 ft. 11 in., and all remaining bays 6 ft. each. The bays are formed by 12 in. wide concrete piers which support a concrete walkway and incorporate slots for the insertion of stoplogs. A gated 5-ft. diameter penstock which can be used as a reservoir drain is located at the right abutment of the spillway. A substantial segment of the Merrymeeting River is controlled by the dam. The upstream pool extends for approximately 4 mi. and serves to attenuate peak flows.

5.2 Design Data

There are no hydraulic/hydrologic design data available for the dam.

5.3 Experience Data

No records of historical floods were located for the Merrymeeting River. According to the operator, the river has never risen more than 6 in. above the stoplogs in the past 20 years.

5.4 Test Flood Analysis

Based on the Corps of Engineers Guidelines, the recommended test flood for the size "intermediate" and hazard potential "high" is the Probable Maximum Flood (PMF). The PMF was determined using the Corps of Engineers Guidelines for "Estimating Maximum Probable Discharge" in Phase I Dam Safety Investigations. The upper 11 sq. mi. of the watershed was assumed to be controlled by Merrymeeting Lake and was therefore not included in the development of the test flood inflow. The remaining 23.5 sq. mi. of the tributary drainage area is drained by the Merrymeeting River and Coffin Brook, both of which are relatively flat. A peak inflow rate of 550 csm was selected for the PMF inflow which results in a test flood inflow of 12,900 cfs.

Surcharge storage routing of the test flood inflow, assuming 2.8 ft. of stoplogs in place, resulted in a routed test flood outflow of 10,200 cfs at a stage elevation of 533.8. The routing did not consider the potential additional upstream surcharge storage that may exist due to the probable hydraulic constrictions of the Gilmanton Road and Route 28 bridges located upstream of Alton Power Dam on the Merrymeeting River. At test flood stage, the dam would be overtopped by approximately 4.5 ft. With all stoplogs removed, the routed test flood outflow is determined to be 9,700 cfs at flood stage elevation of 532.6 or 3.3 ft. above top of dam.

5.5 Dam Failure Analysis

Based on Corps of Engineers Guidelines for estimating dam failure hydrographs, and assuming that a failure would occur in the left embankment which is slightly less than 40 percent of the overall length of the dam, the peak failure outflow is estimated to be 7,000 cfs in addition to the 1,400 cfs spillway discharge occurring prior to failure. As a result of a dam failure, substantial flooding would occur to approximately 20 residential homes, a motel and a marina which are all located along the 1 mile reach of the Merrymeeting River between the dam and Alton Bay. The increase in downstream channel water depth resulting from a failure would produce stages approximately 2 to 6 ft. above the sill elevations of existing homes. Most of these structures would not be flooded prior to a failure of the Alton Power Dam.

The potential loss of life and property resulting from a dam failure would be great and the dam is accordingly classified in the "high" hazard category.

SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

There was no visual evidence of settlement, lateral movement or other signs of structural instability of the concrete portions of Alton Power Dam. However, the spill-way was obscurred by flowing water during the site examination making a detailed observation impossible. Based on conditions which were observed, no reason was found to question the structural stability of the spillway.

There was no visual evidence of settlement or lateral movement in the earth embankment. However, the seepage observed downstream of the left embankment during the site examination could cause piping and potential instability.

6.2 Design and Construction Data

Design plans and specifications for Alton Power Dam were located. The spillway weir was designed to be constructed over portions of an old dry-laid stone dam that previously occupied the site. Part of the structure is founded directly on the streambed soils. The exact configuration of the dam's foundation is not delineated on the plans. It is essentially the same foundation used for the prior dry-laid stone dam. A proposed concrete cutoff wall is indicated on the plans, but, the extent of the wall as constructed is not known. It is therefore not practical to determine the theoretical stability of the structure by calculations. However, the general dimensions of the spillway cross-section are within the range of what usually would be expected for a stable structure of this size. For this reason, combined with the conditions observed during the site examination, the spillway is expected to have an adequate factor of safety relative to overall stability.

The original specifications called for the earth embankment (dike) at the left end to have a crest width of 8 ft. and steep upstream and downstream slopes of 1.5 horizontal to 1 vertical. The fill was to be compacted by some means of rolling. No criteria on the type of soil used, or its gradation, was given in the original specifications. The lack of available information on the

construction and composition of the embankment, makes it unfeasible to evaluate its stability by conventional analysis. However, the embankment crest width and side slopes, though somewhat steep, are generally consistent with usual design practice. Past performance of the embankment has been satisfactory and in the absence of seepage problems, the embankment would be expected to be stable. But, the seepage occurring along the left downstream channel is of significance and places the overall stability of the embankment in question.

6.3 Post-Construction Changes

The dam was rehabilitated during 1959 after the ownership was transferred to the Fish and Game Department. Little is known about the extent of the rehabilitation as no plans of the work were located. However, field measurements and newspaper clippings appear to indicate various portions of the spillway were refaced which should have no material effect on the spillway's structural stability.

6.4 Seismic Stability

Alton Power Dam is located in a Seismic Zone 2 and in accordance with Recommended Phase I Guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual examination of the masonry portion of Alton Power Dam revealed that this part of the structure was in good condition. The seepage detected during the examination of the left earth embankment warrants attention and places the dam in a generally fair condition. No signs of impending structural failure or other conditions which would warrant urgent remedial action were observed.

Based on the results of computations included in Appendix D and described in Section 5, the spillway is not capable of passing the test flood, which for this structure is the PMF. The routed test flood outflow of 10,200 cfs (inflow 12,900 cfs or 550 csm) would overtop the dam by about 4.5 ft., assuming 2.8 ft. of stoplogs in place. With the water level at the top of dam the spillway capacity with stoplogs in place is about 1,410 cfs, which is 14 percent of the routed test flood outflow. With all stoplogs removed, the routed test flood outflow is about 9,700 cfs and the spillway capacity at top of dam is about 3,730 cfs, or 38 percent of the routed test flood outflow.

- b. Adequacy of Information. This evaluation of the dam is based primarily on visual examination, preliminary hydraulic and hydrologic computations, consideration of past performance and application of engineering judgement. Generally, the information available or obtained was adequate for the purposes of a Phase I assessment. However, it is recommended that additional information regarding the condition of the unobserved portion of the spillway, the composition of the left embankment and as-built configuration of the left wingwall as outlined in Section 7.2, be obtained.
- c. <u>Urgency</u>. The recommendations for additional investigations and remedial measures outlined in Sections 7.2 and 7.3, respectively, should be undertaken by the Owner and completed within one year after receipt of this report.

7.2 Recommendations

It is recommended that the following investigations be performed under the direction of a registered professional engineer:

- 1. A detailed hydraulic/hydrologic investigation to determine the need and means for increasing the spillway capacity.
- 2. Perform an investigation to determine the nature of the observed seepage, its effect on the stability of the left embankment and possible means of providing cut-off. As part of this investigation, a small wooden weir, or some other means, should be installed to measure the quantity of seepage occurring in the area of the old dry-laid stone wall. Variations in seepage flow could then be correlated with rainfall, snowmelt and reservoir level.
- 3. Perform an inspection of the spillway during a period of low flow to assess its structural condition.
- 4. Perform an investigation to determine the required work to insure the operability of the outlet works and make the penstock supports structurally adequate. An alternative to the rehabilitation of the penstock supports would be to remove the penstock as it now exists. A small portion could be cantilevered from the gate house wall to serve as the outlet works discharge pipe.

The Owner should then implement corrective measures on the basis of the engineering evaluations.

7.3 Remedial Measures

Although the dam is generally in fair condition, it is considered important that the following items be accomplished:

- a. Operation and Maintenance Procedures. The following should be undertaken by the Owner:
 - 1. Repair the spalled areas of concrete on the outlet works head walls and the cracks in the concrete, at the downstream face of the outlet works.
 - 2. Repair the timber stoplog supports.
 - 3. Cut and remove the trees and brush located on the crest and slopes of the left embankment. If the stumps are left in place or removed, with voids

filled, should be determined in conjunction with the seepage investigation recommended above. In either case, a selective procedure of tree removal should be used.

- 4. Clear away leaves and vegetation in the vicinity of the seepage on the left downstream slope and make periodic visual observations noting carefully the extent and location of wet areas.
- 5. Prepare an operations and maintenance manual for the dam. The manual should include provisions for annual technical inspection of the dam and for round-the-clock surveillance of the dam during periods of heavy precipitation and high discharges. The procedures should delineate the routine operational procedures and maintenance work to be done on the dam to ensure safe, satisfactory operation and to minimize deterioration of the facility.
- 6. Develop a written emergency preparedness plan and warning system to be used in the event of impending failure of the dam or other emergency conditions for the specific dam. The plan should be developed in cooperation with local officials and downstream inhabitants and should compliment the existing disaster operations plan, "Link-Up".

7.4 Alternatives

None.

APPENDIX A - INSPECTION CHECK LIST

n

| | Page |
|---|------|
| VISUAL INSPECTION PARTY ORGANIZATION | A-1 |
| VISUAL INSPECTION CHECK LIST | |
| Dam Embankment | A-2 |
| Outlet Works - Spillway Weir, Approach and Discharge Channels | A-3 |
| Outlet Works - Bridge over Spillway | A-4 |
| Outlet Works - Intake Channel and Intake Structure | A-5 |
| Outlet Works - Control Tower | A-5 |
| Outlet Works - Perstock and Penstock Outlet | A-6 |

VISUAL INSPECTION PARTY ORGANIZATION NATIONAL DAM INSPECTION PROGRAM

Dam: Alton Power

Date: 1-2 November 1979

1330 to 1530 - 1 November 0730 to 1130 - 2 November Time:

Weather: Clear with moderate temperatures $(60^{\circ} \text{ to } 65^{\circ}\text{F})$

Water Surface Elevation Upstream: 526.2 (NGVD)

Stream Flow: Unknown

Inspection Party:

- Soils/Geology Harl P. Aldrich, Jr.

Charles R. Nickerson Haley & Aldrich, Inc.

Joseph E. Downing Hydraulic/Hydrologic Francis Luttazi Structural/Mechanical

Camp, Dresser & McKee, Inc.

Present During Inspection:

Kenneth T. Stern, State of New Hampshire, Water Resources Board, 1 November

Franklin Alden, Sr., State of New Hampshire, Fish and Game Department, 2 November

DAM: Alton Power Dam DATE: 1 Nov. 79

| AREA EVALUATED | CONDITION |
|--|--|
| DAM EMBANKMENT (Left end of spillway) | |
| Crest Elevation Current Pool Elevation Maximum Impoundment to Date | El. 529.3 El. 526.2 Unknown |
| Surface Cracks Pavement Condition Movement or Settlement of Crest | None observed No pavement None observed, but some settlement may have occurred adjacent to left |
| Lateral Movement Vertical Alignment Horizontal Alignment Condition at Abutment and | spillway training wall None observed Satisfactory Satisfactory Satisfactory; some erosion adjacent |
| at Concrete Structures Indications of Movement of Structural Items on Slopes | to left spillway training wall No structural items on slopes |
| Trespassing on Slopes Animal Burrows in Embank- ment | Unrestricted, but not common None observed |
| Vegetation on Embankment | Grass, weeds, small saplings and a few large trees, especially on downstream slope |
| Sloughing or Erosion of Slopes or Abutments | Some sloughing on downstream slope, not recent but includes boulders and other surface debris |
| Rock Slope Protection - Riprap Failures | No rockfill or riprap |
| Unusual Movement or Crack- ing at or Near Toes Unusual Embankment or Down- stream Seepage | None observed, but downstream slope irregular and hard to examine Considerable seepage, 200 to 300 gpm, at locations shown on page C-1. Water clear (see text) |
| Piping or Boils Foundation Drainage Features | None observed None known to exist |
| Toe Drains Instrumentation Systems | None known to exist None |
| | A-2 |

HALEY & ALDRICH, INC. CAMBRIDGE, MASSACHUSETTS

DAM: Alton Power Dam DATE: 1 Nov. 79

| AREA EVALUATED | CONDITION |
|---|---|
| OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS | |
| a. Approach Channel | |
| General Condition | Spillway weir fronts on Wentworth |
| Loose Rock Overhanging Channel | Not applicable |
| Trees Overhanging Channel Floor of Approach Channel | Trees were observed overhanging left side of channel Not observable. Submerged |
| b. Weir and Training Walls | |
| General Condition of Concrete | Good |
| Rust or Staining | Minor staining observed at flashboard bays |
| Spalling Any Visible Reinforcing Any Seepage or Efflo- rescence | None observed None observed Not observable |
| Drain Holes | None observed |
| c. Discharge Channel | |
| General Condition Loose Rock Overhanging Channel | Fair Not applicable |
| Trees Overhanging Channel | Right and left embankments of dis- charge channel noted to be wooded areas with several overhanging trees on both sides |
| Floor of Channel | Floor of discharge channel obstructed by mature tree growth, stone rubble and debris |
| Other Obstructions | Remains of old wooden penstock and concrete cradle supports were observed at the right of the discharge channel downstream of the gatehouse |
| | A-3 |

HALEY & ALDRICH, INC. CAMBRIDGE, MASSACHUSETTS

DAM: Alton Power Dam DATE: 1 Nov. 79

| AREA EVALUATED | CONDITION |
|---|--|
| OUTLET WORKS - BRIDGE OVER | |
| a. Super Structure | |
| Anchor Bolts Bridge Seat Longitudinal Members Under Side of Deck Secondary Bracing Deck Drainage System Railings Expansion Joints Paint | Not applicable - Concrete slab deck monolithic with spillway abutments Not applicable - see "Bearings" Not applicable - see "Bearings" Not applicable Minor spalling observed Not applicable Concrete deck in good condition. Evidence of recent repair work for localized spalling noted None observed One railing observed at D/S side of walkway. Several posts show signs of advanced rusting but their size is substantial and all railing components were observed to be structurally sound None observed Minor chipping of railing paint noted. Rust staining also noted at the |
| b. Abutment & Piers | railing. Concrete deck is not painted |
| General Condition of Concrete Alignment of Abutment Approach to Bridge | Good. Spalling observed behind (left side) left bridge abutment Good Approach to bridge from the left consists of wooded, earthen dam embankment. A grass covered earthen dam embankment constitutes the right approach |
| Condition of Seat and Backwall | Not applicable - see "Bearings" |
| | A-4 |

HALEY & ALDRICH, INC. CAMBRIDGE, MASSACHUSETTS

DAM: Alton Power Dam DATE: 2 Nov. 79

| AREA EVALUATED | CONDITION |
|--|--|
| OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE | |
| CHANNEL AND INTAKE STRUCTURE | |
| a. Approach Channel | <pre>Intake approach channel is common to spillway weir approach channel. See "Outlet Works - Spillway Weir, Approach and Discharge Channels"</pre> |
| b. Intake Structure | <pre>Intake structure is common to gate- house facility. See "Outlet Works- Control Tower"</pre> |
| OUTLET WORKS - CONTROL TOWER | |
| a. Concrete and Structural | |
| General Condition Condition of Joints Spalling | Good Good Spalling observed at both right and left headwalls at gate chamber inlet beneath gatehouse |
| Visible Reinforcing Rusting or Staining of Concrete | None observed None observed |
| Any Seepage or Efflo- rescence | None observed |
| Joint Alignment Unusual Seepage or Leaks in Gate Chamber | Good Not observable. Submerged |
| Cracks | Evidence of cracking observed at right inside wall of gate chamber beneath gate house, apparently originating at spalled area in the right abutment of the gate chamber inlet channel. (See "Spalling" above). Cracking observed at D/S face of gate house facility just above penstock exit |
| Rusting or Corrosion of Steel | None observed |
| | A-5 |

HALEY & ALDRICH, INC. CAMBRIDGE, MASSACHUSETTS

DAM: Alton Power Dam DATE: 2 Nov. 79

| AREA EVALUATED | CONDITION |
|---|--|
| b. Mechanical and Electrical | |
| Air Vents Float Wells | None observed None observed |
| Crane Hoist | None observed |
| Elevator | None observed |
| Hydraulic System | None observed |
| Service Gates | 6.5 ft. by 6.5 ft. wooden gate con- trolled by manually operated ratchet type gate mechanism. Gate lift mechanism was inoperable at time of inspection |
| Emergency Gates | None |
| Lightning Protection System | None observed |
| Emergency Power System Wiring and Lighting | None |
| System in Gate Chamber | None |
| OUTLET WORKS - PENSTOCK AND PENSTOCK OUTLET | A 4'-10½" inside diameter riveted steel penstock serves as the outlet for the gate house facility. Evidently the steel penstock fed into a wooden penstock at one time, which carried flow to a power station downstream of the dam. The wooden penstock is completely deteriorated while the riveted steel portion of pipe was noted to be structurally sound. The support system for the piping consisted of concrete cradles, only one of which was observed to be in serviceable condition. The remainder of the cradles have been dislodged from their original positions and exhibit various degrees of deterioration. |
| | There exists approximately 33 ft. of |
| | |

NO 4454

HALEY & ALDHICH, INC. CAMBRIDGE, MASSACHUSETTS

DAM: Alton Power Dam DATE: 2 Nov. 79

| AREA EVALUATED | CONDITION |
|--|--|
| | riveted steel pipe, 16 ft. of which is cantilevered from the cradle support noted above. Capacity for full pipe flow is questionable due to this condition |
| Erosion or Cavitation | There were no erosion or cavitation conditions noted at the penstock outlet |
| | |
| HALEY & ALDRICH, INC. CAMBRIDGE, MASSACHUSETTS | A-7 |

APPENDIX B - ENGINEERING DATA

| | Page |
|---|--------------|
| LIST OF AVAILABLE DATA | B-1 |
| PRIOR INSPECTION REPORTS | |
| Date Description | |
| 22 July 1935 New Hampshire Water Resources Board 28 Sept 1938 New Hampshire Water Control Commission 7 August 1950 New Hampshire Water Control Commission, | B-4 B-9 |
| Report on Dam Inspection 27 October 1975 New Hampshire Water Resources Board | B-11 B-13 |
| DRAWINGS | |
| "Sheet-A, General Plan & Survey, Hydroelectric Development, Alton, N.H., George H. Jones, New Durham, N.H.", I.W. Jones & Co., Engineers, Milton, N.H., 1921 | B-16 |
| "Sheet-B, Plan, Elevation and Sections Thru Dam and Forebay, Hydroelectric Development, Alton, N.H., Geo. H. Jones, New Durham, N.H.", I.W. Jones & Co., Engineers, Milton, N.H., undated | B-17 |
| "Sheet-E, Details of Abutment and Forebay, Hydroelectric Development, Alton, N.H., George H. Jones, New Durham, N.H.", I.W. Jones & Co., Engineers, Milton, N.H., 24 July 1923 | B-18 |

LIST OF AVAILABLE DATA ALTON POWER DAM

| Location | Water Resources Board State of New Hampshire 37 Pleasant Street Concord, New Hampshire 03301 | Water Resources Board State of New Hampshire | Water Resources Board State of New Hampshire | Water Resources Board State of New Hampshire | Water Resources Board State of New Hampshire |
|----------|---|---|--|--|---|
| Contents | Lists the owner's name and address for dams in Alton dated 27 November 1917 | Original specifications for construction of dam dated 16 July 1922 | Letter sent to State of New Hampshire for approval of then proposed dam dated 7 August 1922 | Ten items dated from 21 August 1923 to 16 July 1935 | Lists the owner's and address for dams in Alton dated 26 June 1935. Index lists dam's name, location, owner and owner's address |
| Document | Information regarding dams in the Town of Alton | Specifications and Contract for Construction of Concrete Dam, Forebay and Dikes at Alton, N.H. for George H. Jones, New Durham, N.H., I.W. Jones & Company, Engineering, Milton, N.H. | Letter from I.W. Jones & Co. to Public Service Commission, Concord, N.H. | Miscellaneous correspondence | Report schedule of dams, Town of Alton, New Hamp- shire and an index of dams in Alton |

| | Location | Water Resources Board State of New Hampshire 37 Pleasant Street Concord, New Hampshire 03301 (See Appendix pages B-4 through B-7) | Water Resources Board State of New Hampshire (see Appendix page B-8) | Water Resources Board State of New Hampshire (see Appendix pages B-9 and B-10) | Water Resources Board State of New Hampshire | Water Resources Board State of New Hampshire | Water Resources Board State of New Hampshire |
|--|----------|--|---|---|--|--|---|
| LIST OF AVAILABLE DATA ALTON POWER DAM (continued) | Contents | Inspection report with data on dam and power develop-ment, two pictures of dam and hand drawn figures of dam dated 22 July 1935 | Information in reference to 22 July 1935 inspection dated 11 September 1935 | Information sheets on dam and power development dated 28 September 1938 | Survey data sheet on dam per- formance during flood of September 21-24, 1938, dated 26 October 1938 | Information tabulated on 13 Vapril 1939 | Questionnaire checking infformation on file dated 16 |
| | Document | New Hampshire Water Resources Board Inventory of Dams and Water Power Developments | Dam Record | New Hampshire Water Control Commission, data sheets | Water Control Commission form letter to George H. Jones | Data on Reservoirs and Ponds in New Hampshire | Questionnaire, Water Powers of New Hampshire and Index card |

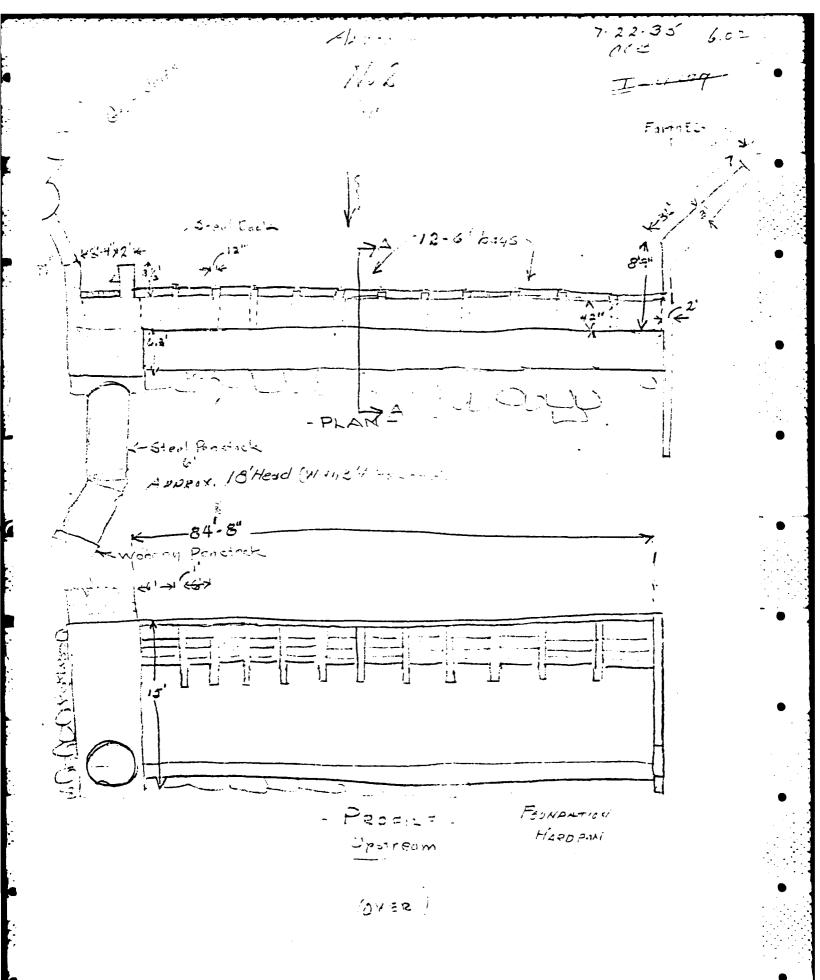
LIST OF AVAILABLE DATA ALTON POWER DAM (continued)

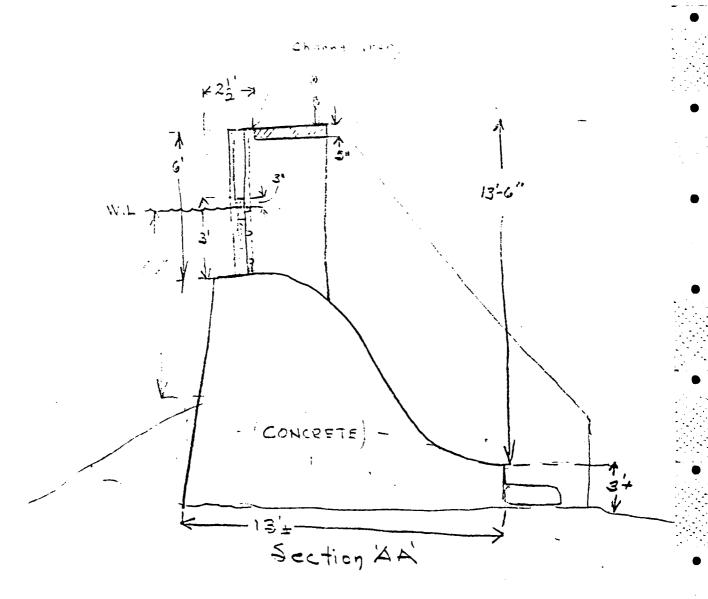
| Location | Water Resources Board State of New Hampshire (see Appendix pages B-11 and B-12) | Water Resources Board State of New Hampshire | Water Resources Board State of New Hampshire (see Appendix pages B-13 through B-15) | Water Resources Board State of New Hampshire |
|----------|--|--|---|---|
| Contents | Inspection record and accompany sketch on dam dated 7 August 1950 | Note on date N.H. Fish and Games purchased dam about 1962, undated | Inspection by N.H. Water Resources Board including two photographs dated 27 October 1975 | Notification to owner on results of dam inspection on 27 October 1975 |
| Document | Report on Dam Inspection | Мето | Dam Safety Inspection Report | Letter to Fish & Game Department |

NEW HAMPSHIRE WATER RESOURCES BOARD

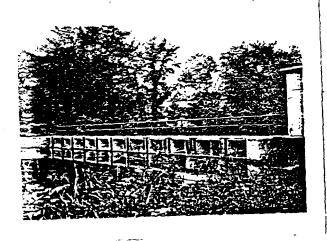
INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

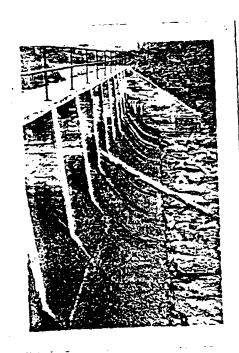
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| RALL LINGTH OF DAM-FT. 784 | DAX.FLCCD HEIGHT ABOVE CREST-FT. |
| MAMENT CREST ELEV.U.S.G.S | Cog. 32 LOCAL GAGE |
| EVATER ELEV.U.S.G.S. | LCCAL GAGE |
| LLWAY LINGTHS-FT 1/4/2 - FA | FREEBCARD-FT. G |
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| | Co-ordinates from A E |
| ER DEVELOPMENT | 100-01 din 1465 from A E |
| D/ 000- | 1/10/50 - 5,300 ft. |
| RATED HEAD C.F.S | |
| TS NO. HP FEET FULL O | |
| 1 160 18 | 120 24"/04-21/20-10- |
| | 120 - 2.5. 2000 21.6 A |
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| Paragon | |
| Program | • |
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MERRYMEETING RIVER IN ALTON July 22, 1935 George H. Jones





PUBLIC SERVICE COMMISSION OF NEW HAMPSHIRE-DAM RECORD I-4077 STATE TOWN TOWN Alton NO. NO. Merrymeeting Eiver RIVER STREAM 37 Sq. Mi. DRAINAGE POND AREA AREA DAM FOUNDATION Herdpan Gravity NATURE OF TYPE MATERIALS OF Concrete CONSTRUCTION POWER-CONSERVATION-DOMESTIC-RECREATION-TRANSPORTION-PUBLIC UTILITY .. PURPOSE OF DAM TOP OF DAM TO HEIGHTS, TOP OF 15' 61-0" DAM TO BED OF STREAM SPILLWAY CRESTS LENGTH 1361 341-8" 12-6' bays SPILLWAYS, LENGTHS DEPTHS BELOW TOP OF DAM Removable FLASHBOARDS 3!-C" TYPE, HEIGHT ABOVE CREST OPERATING HEAD TOP OF FLASHBOARDS 181 181 TO N. T. W. CREST TO N. T. W. 160 EP 1-Leffel Vertical Turbine WHEELS, NUMBER KINDS & H. P. G. F. A. C. Direct Conjected Vertical GENERATORS, NUMBER 4000V-21.64 120 KW. 60 Cycle 5 KINDS & K. W. H. P. 75 P. C. TIME H. P. 90 P. C. TIME 100 P. C. EFF. 100 P. C. EFF. REFERENCES, CASES, PLANS, INSPECTIONS.

REMARKS

OTHER- Mr. George H. Jones

COMDITION- Good

MENACE- Yes. Will be subject to periodic inspection.

To the Public Service Commission:

The foregoing memorandum on the above dam is submitted covering inspection made July 22, 1935 according to notification to owner dated July 15, 1935, and bill for same is enclosed.

Sept. 11, 1935 Copy to Owner Samuel J. Lord Hyd. Eng.

NEW Hampshire Water Control Commission Data on Dams in New Hampshire

| LOCATION | STATE NO |
|--|-------------------------------------|
| | : County |
| StreamLeven Zentang Rawen | |
| Basin-Primary | Secondary Land dant Land |
| | |
| Coordinates—Lat. 42° 251+14,7 | <u> </u> |
| GENERAL DATA | · |
| Drainage area: Controlled Sq. | Mi.: Uncontrolled |
| | ite of Construction1902 |
| Height: Stream bed to highest elev | .15 ft.: Max. Structure 9 ft |
| Cost—Dam | Reservoir |
| DESCRIPTION Gravity Type Con- | orete Const. on Lard pan foundation |
| Waste Gates | |
| Туре | |
| Number: Size | ft. high x ft. wide |
| Elevation Invert | sq. ft |
| Hoist | |
| Waste Gates Conduit | |
| Number: | Materials |
| Size ft.: Length | ft.: Area sq. ft |
| Embankment | |
| Type | |
| Height—Max. | ft.: Min ft |
| Top-Width | : Elev ft |
| Slopes—Upstream on | : Downstream on |
| Length-Right of Spillway | : Left of Spillway |
| Spillway | |
| Materials of ConstructionConox | ete |
| Length—Total 34!6(126 | t.Bays). ft.: Net f |
| | 9. ft.: Min |
| Flashboards—TypeStop Plank | E-Remonable : Height3! 5! remons |
| Elevation—Permanent Crest | : Top of Flashboard |
| Flood Capacity4825 | cfs.:150 cfs/sq. mi. |
| Abutments | |
| Materials:Gaggon4 | |
| Freeboard: Max5 | ft.: Min f |
| Headworks to Power Devel.—(See "Da | ta on Power Development") |
| OWNER Racings H. Jones Talkon. | Box N. H |
| REMARKS G H Jones owns full Condition Good | L mater rights |
| | 3-9 |

Tabulation By A. A. H. S. A. H. T. Date South 02, 1223

NEW MPSHIRE WATER CONTROL CC MISSION DATA ON WATER POWER DEVELOPMENTS IN NEW HAMPSHIRE

| LOCATION | AT DAM NO |
|----------------------------|---|
| | : County331/2000 |
| Stream Manny Zeating Riv | 9 d m |
| Basin-Primary Namuinani R. | iver : Secondary Leito Victoriascules |
| Local Name | lls |
| GENERAL DATA | |
| Head-Max ft.: Min. | ft.: Ave. 13'21/74 & F1.404 E9.2425 ft. |
| Date of Construction192.E | : Use of Power |
| | ac. ft.: Storage ac. ft. |
| DESCRIPTION | · |
| Racks | |
| Size of Rack Opening | |
| Size of Bar | |
| Area: Gross | |
| Head Gates | • |
| | |
| | ft. high x ft. wide |
| | : Total Areasq. ft |
| | |
| Penstock | |
| | : Material Steel & Wood |
| | : Length |
| Turbines | Dong W |
| Number | : MakersLoffel Wortical |
| | 130 H P : Total Capacity |
| *- · | : Total cfs |
| Drive | |
| | |
| Generator | ······································ |
| | |
| NumberI | rect Connected Vertical |
| | |
| Rating Kyun per unit and a | K. W |
| Exciter | 35.1 |
| | : Make |
| | Total Capacity K. W |
| OUTPUT—KWHRS | 4.0 |
| 10 | : 19 |
| | • • |
| 19 | |
| 19 19 | : 19 |
| 19 19 | : 19: 19: 19: |
| 19 19 19 19 | : 19: 19: 19: |

NEW HAMPSHIRE WATER CONTROL COMMISSION

REPORT ON DAM INSPECTION

| TOWN. | DAM NO. STREAM |
|-------|--|
| OWNER | Public Sourier Const de ADDRESS Mondanier M. 4. |
| | In accordance with Section 20 of Chapter 133, Laws of 1937, the above dam was cted by me onaccompanied by |
| MOZES | ON PHYSICAL CONDITION Abutmonts Code Telegraph Code Code Code Code Code Code Code Code |
| | Soillway Fiel - Down town to year of everly |
| | Gates: Committee Mander Land Land Committee Co |
| | Cther |
| CHANG | ES SINCE LAST INSPECTION - Contact of the Contact o |
| FULUE | E INSPECTIONS 4 |
| : | This dam (is) (is not) a monaco bocauso |
| 27.02 | 25 Poul done 4.15' from typot down |
| | |
| | Copy to Comer Dato INSPECTOR |

(Additional Notes Over)

| HAMPSHIRE | PROJECT | | | | ····· | FILE | |
|------------|---|---|--|-------------------|---|------|-----|
| RESOURCES | SUBJECT | | | | | | ••• |
| ORD, N. H. | | CHECKER | CO## | COMT | SUMMARY | | |
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B-12

N. H. WATER RESCURCES BOARD Concord, N. H. 03301

DAM SAFETY INSPECTION REPORT FORM

| Town: | Alton Dam Number: 6.02 |
|--------------|--|
| Inspected by | : 5 Bunutt Date: 27 Oct 1975 |
| Local name o | f dam or water body: Merrimeting March |
| Owner: | Fish & Game dept Address: |
| | s not interviewed during inspection. |
| Drainage Are | a:sq. mi. Stream: |
| Fond Area: _ | 500 Acre, Storage Ac-Ft. Max. Head /5 Ft. |
| Foundation: | Type Hand pan, Seepage present at toe - Yes/No, |
| Spillway: | Type 12 Stoplo- seets Freeboard over perm. crest: 3 |
| | Width C, SToplos height 3, |
| | Max. Capacityc.f.s. |
| Embankment: | Type, CoverWidth, |
| | Upstream slope to 1; Downstream slope to 1 |
| Abutments: | Type, Condition: Good, Fair, Poor |
| Gates or Pon | d Drain: Size 6'Dia Capacity Type Ponstack |
| | Lifting apparatus ? Operational condition ? |
| Changes sinc | e construction or last inspection: wood sections of |
| Ponsta | ick have been Removed |
| | |
| Downstream d | evelorment: |
| This dam wou | would not be a menace if it failed. |
| | inspection date: |
| Remarks: | Concrete on walk way in poor shape |
| | , |
| | |
| | |
| Overall Cor | dition: Good (Fair) Poor Ruins Removed Breached B-13 |

NEW BAMPSHIDE WATER RESOURCES BOARD

SITE EVALUATION DATA

| OWNER: TIST & Game Do of TELEPHONE NO. |
|---|
| MAILING ADDRESS: Brides st Concert |
| SITE LOCATION (TOWN OR CITY) Alto- |
| NAME OF STREAM OR WATERBODY: Merry westing River QUADRANGLE: Alton LOCATION RT 1 3,04 Dn |
| QUADRANGLE: Alton LOCATION RT 1 3.04 Dn |
| HEIGHT OF (PROPOSED, EXISTING) DAM 'S LENGTH 136 |
| TYPE OF (PROPOSED, EXISTING) STRUCTURE CONCRETE Spillway with |
| DRAINAGE AREA 37 S M POND AREA 500 A |
| AVAILABLE ARTIFICIAL STORAGE: PERMANENT: TEMPORARY: TOTAL |
| EXISTING DEVELOPMENT DOWNSTREAM OF (PROPOSED, EXISTING) STRUCTURE |
| House Alton Doug |
| POTENTIAL DEVELOPMENT DOWNSTREAM OF (PROPOSED, EXISTING) STRUCTURE |
| POTENTIAL DAMAGE FOWNSTREAM OF STRUCTURE (EXPLAIN IN DETAIL AND INCLUDE ANY POTENTIAL LOSS OF LIFE ESTIMATE) Damage To Some 1-10005 |
| washout of the marria Damage To Bridge |
| in Alton Bay |
| OTHER COMMENTS: |
| |
| CLASS OF STRUCTURE NON MENACE: MENACE A B C DAM # 6.02 |
| DATE OF INSPECTION: 32 Oct 75 |
| SIGNED Styl Durity |

SIGNATURE

DATE:



6.02

27 Oct. 75

Alton Stephen Burritt

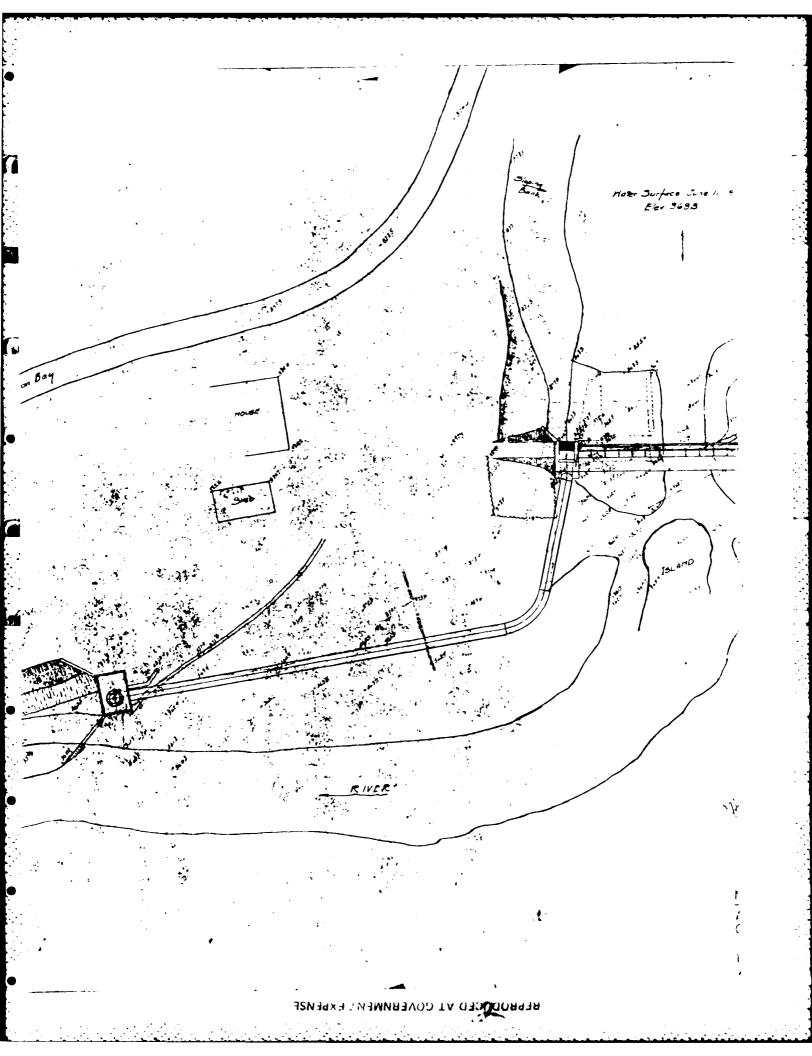


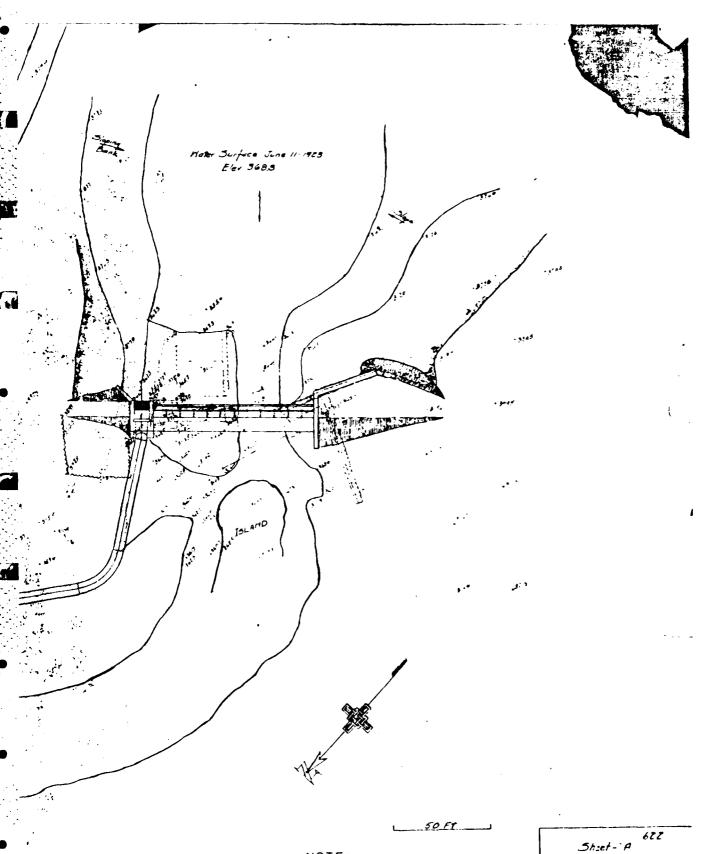
6.02

27 Oct. 1975

Alton Stephen Burritt

FILE NO. 4454 B24





NOTE:

ALL ELEVATIONS GIVEN
ON THIS SHEET ARE
BASED ON AN UNKNOWN
LOCAL OR ASSUMED DATUM
AND NOT NVGD

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Sheet- A

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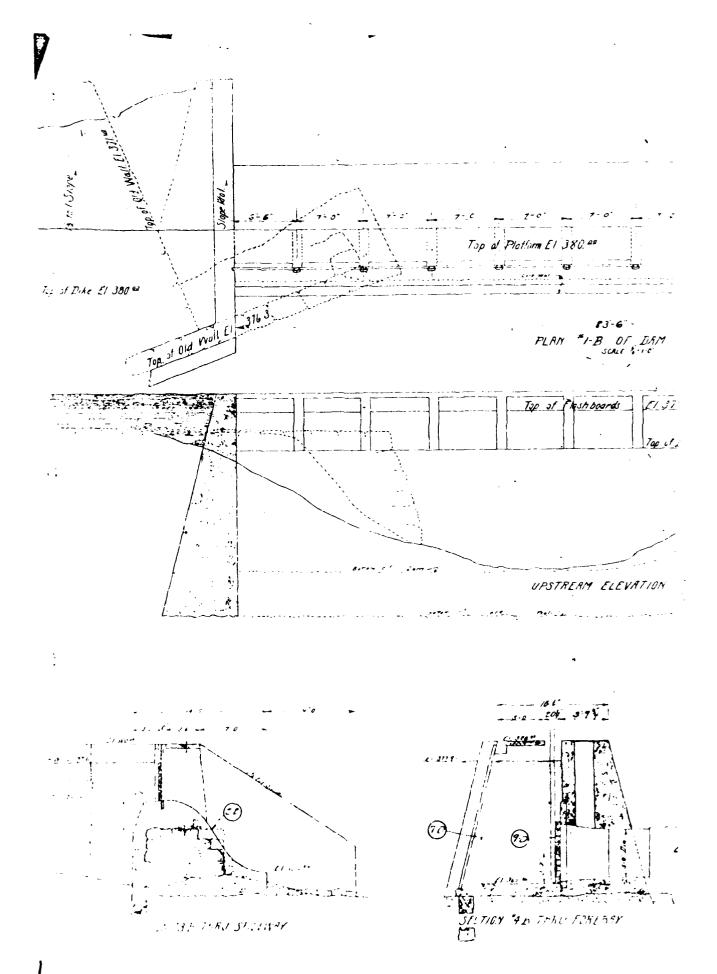
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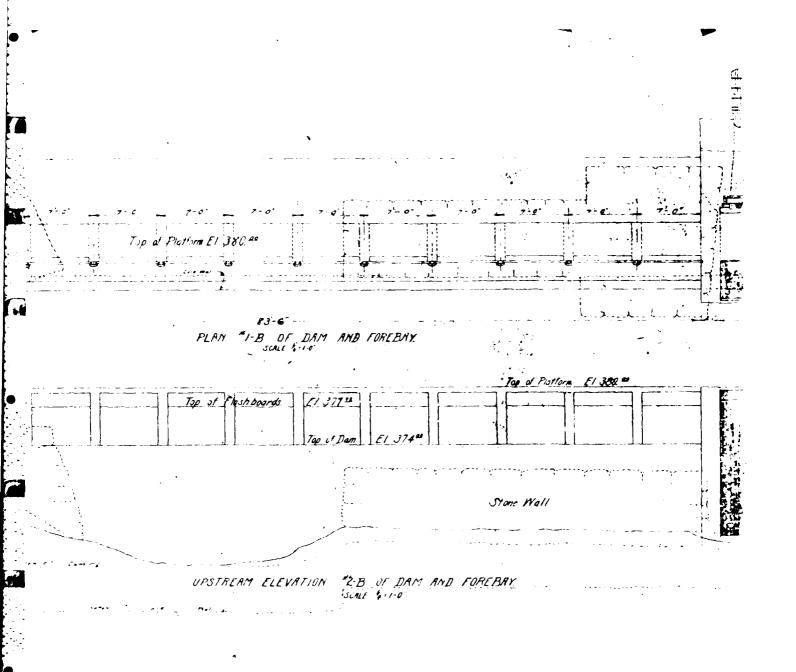
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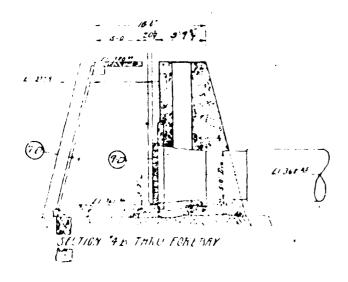
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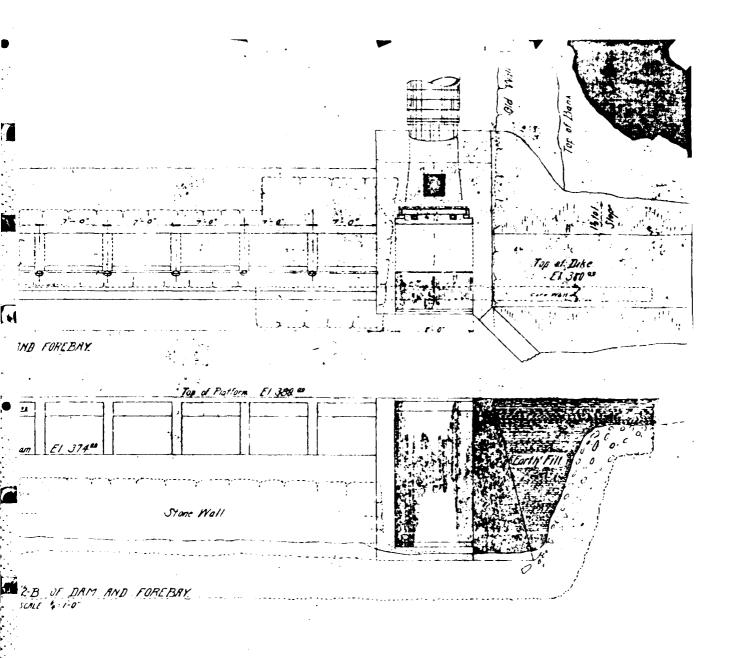






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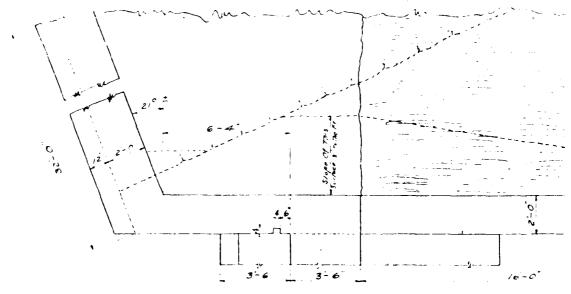
NOTE:

ALL ELEVATIONS GIVEN ON THIS SHEET ARE BASED ON AN UNKNOWN LOCAL OR ASSUMED DATUM AND NOT NVGD

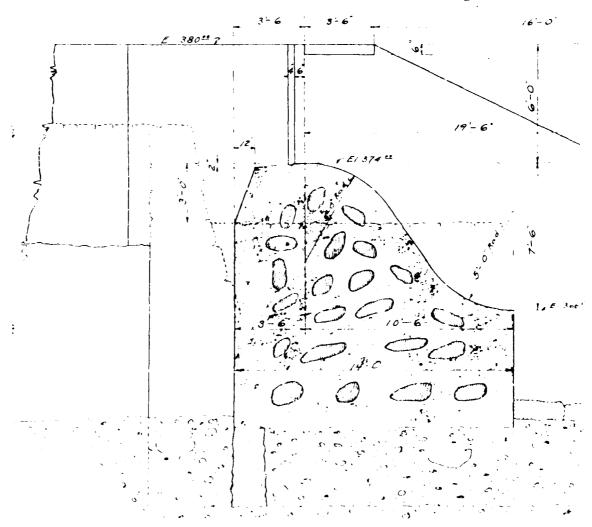
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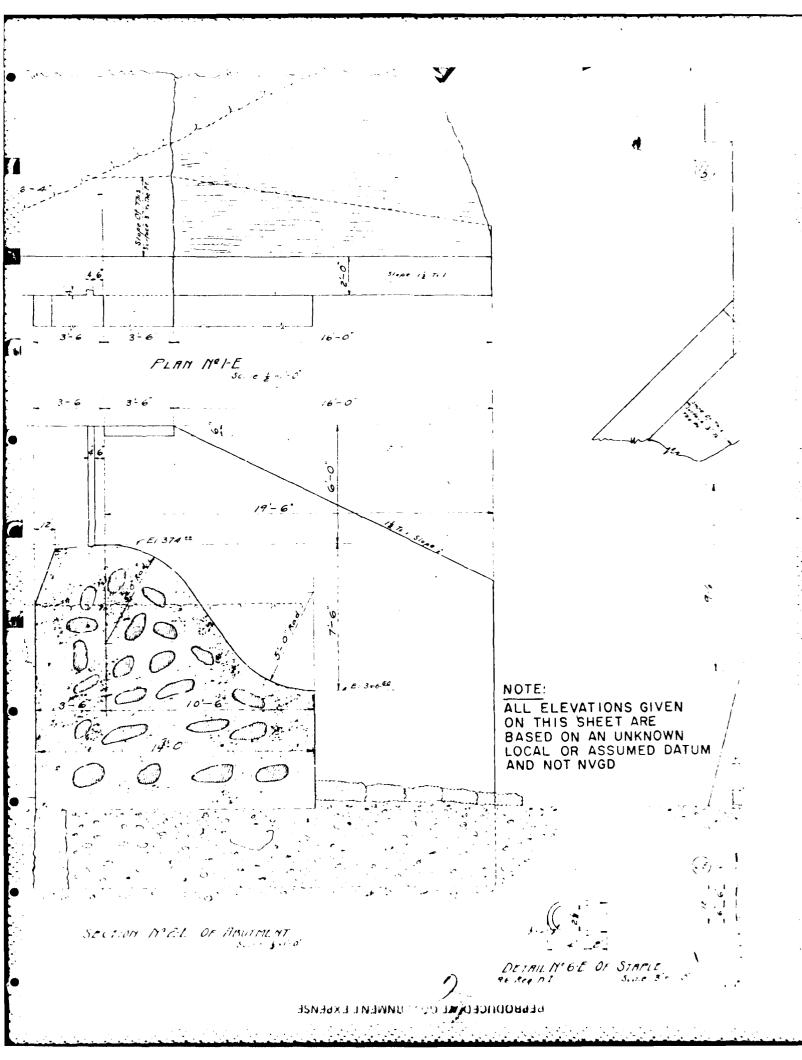
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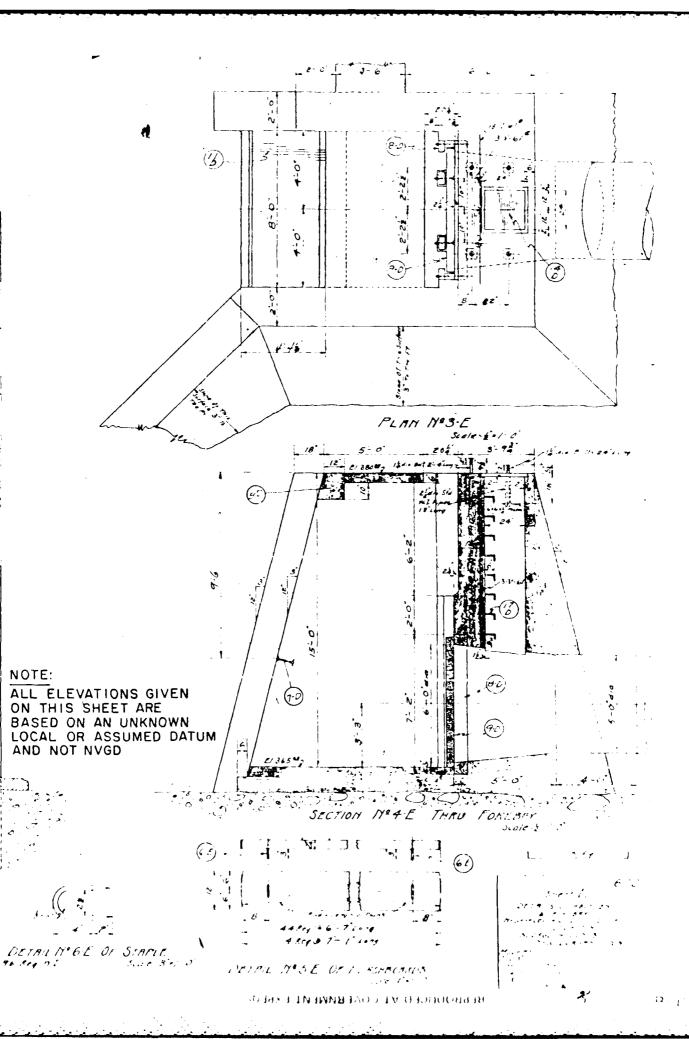


PLAN Nº1-E



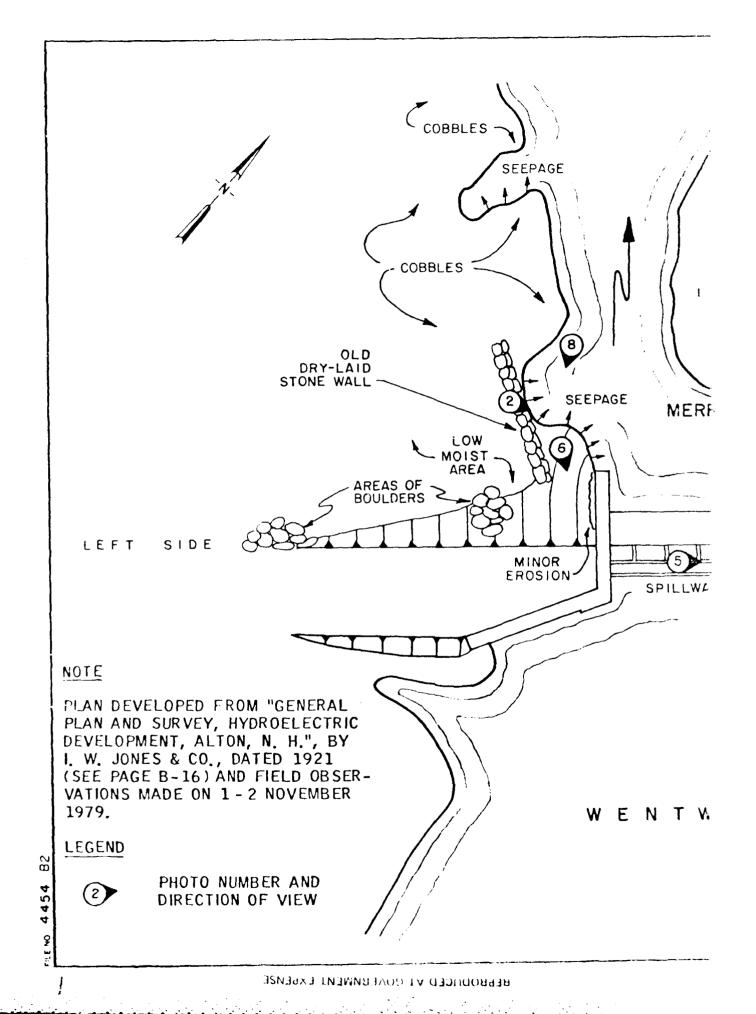
SECTION Nº 2E. OF ABUTMENT Scale \$ 100

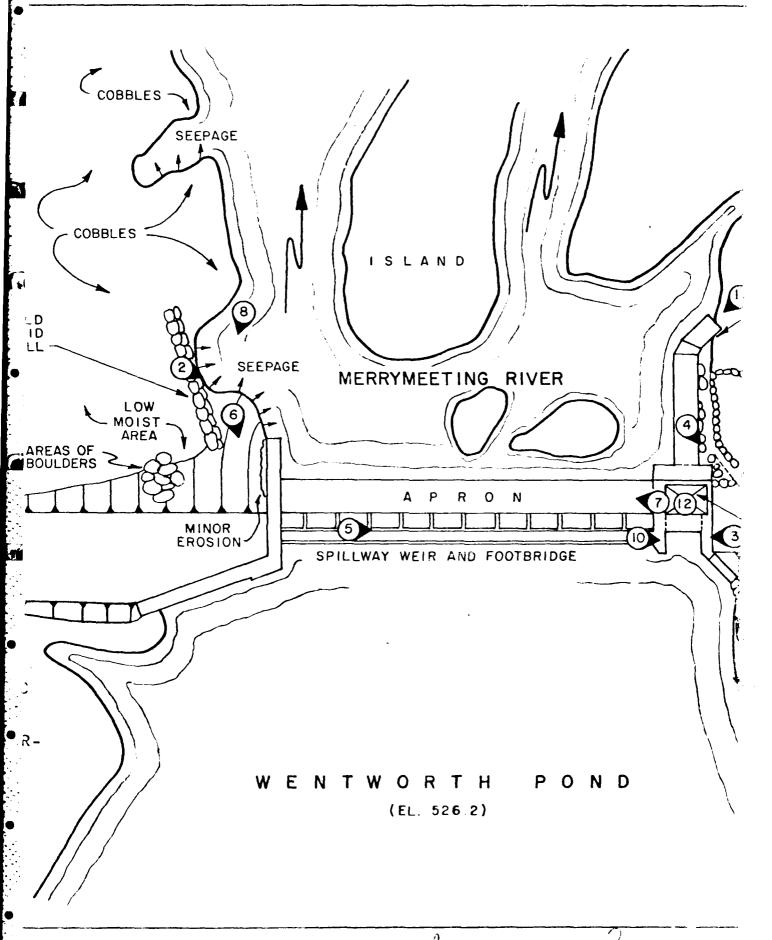


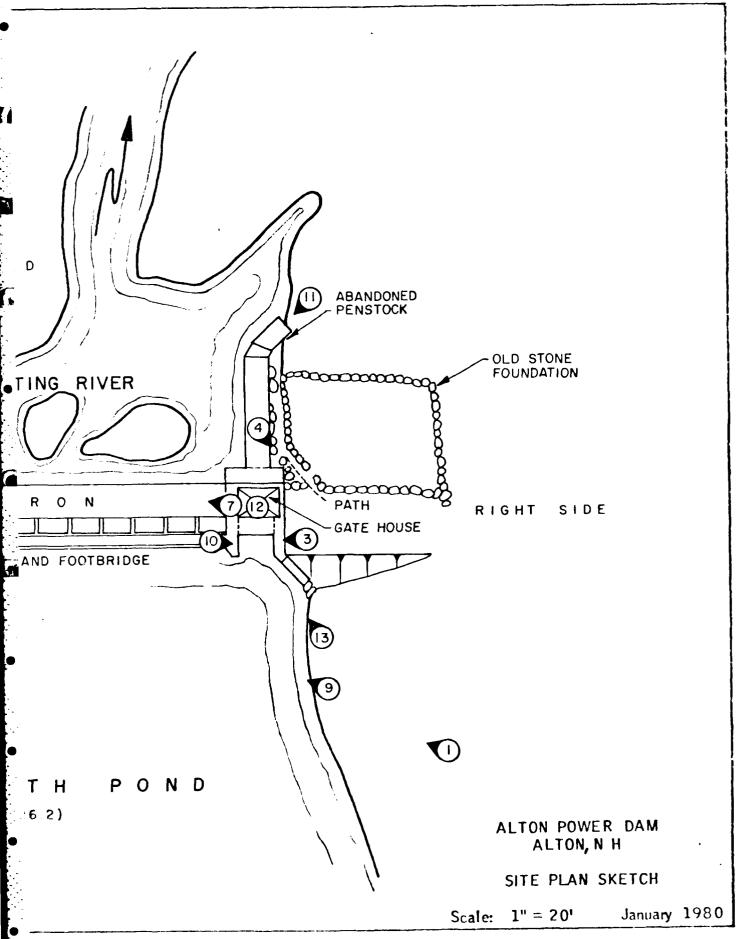


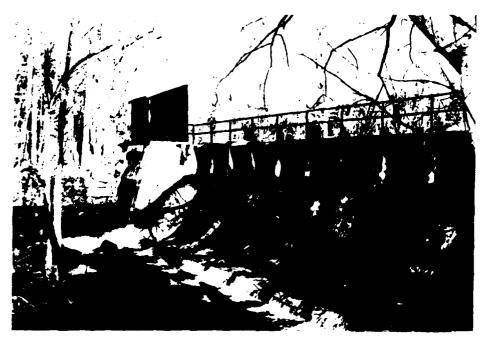
APPENDIX C - PHOTOGRAPHS

| | | | | Page |
|----------|---|--------------|------------|--------------|
| LOCAT | TION PLAN | | | |
| Site | Plan Sketch | | | C-1 |
| PHOTO | OGRAPHS | | | |
| No. | Title | Roll | Frame | Page |
| 1. | Overview of Alton Power Dam showing upstream side | B-7 | 1A | vi |
| 2. | Overview of spillway and downstream channel | 5 | 3 | C-2 |
| 3. | Alignment of dam from right abut- ment | 5 | 21 | C-2 |
| 4. | Path and cobble-concrete repair adjacent to outlet works, downstream | 5 | 17 8A | C-3 |
| 5. 6. | Right side of dam from footbridge Left embankment adjacent to left | B - 7 | 5 S | C-4 |
| 7. | training wall, downstream Old stone masonry wall, left | 5 | J | C 4 |
| _ | training wall and embankment, downstream | B-7 | 7A | C-4 |
| 3. | Close up of area of seepage, downstream toe of left embankment | 5 | 1&2 | C - 5 |
| 9. | adjacent to left training wall Deteriorated stoplog supports | B-7 | 4A | C-6 |
| 10. | along upstream side of spillway Spalling concrete at right head- | <i>5</i> , | 24 | C-6 |
| 11. | wall, upstream Steel penstock, downstream Gate lift mechanism | B-7 B-7 | 15A 16A | |
| 12. | Right headwall, gate house and outlet works intake, upstream | B-7 | 3A | C-3 |
| | | | | |









2. Overview of spillway and downstream channel



3. Alignment of dam from right abutment



4. Path and cobbleconcrete repair adjacent to outlet works, downstream



5. Right side of dam from footbridge



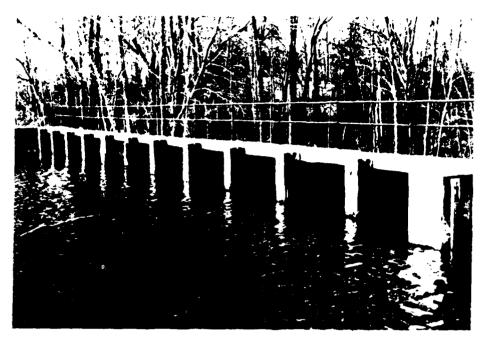
 Left embankment adjacent to left training wall, downstream



7. Old stone masonry wall, left training wall and embankment, downstream



Close up of area of seepage, downstream toe of left embankment adjacent to left training wall . α

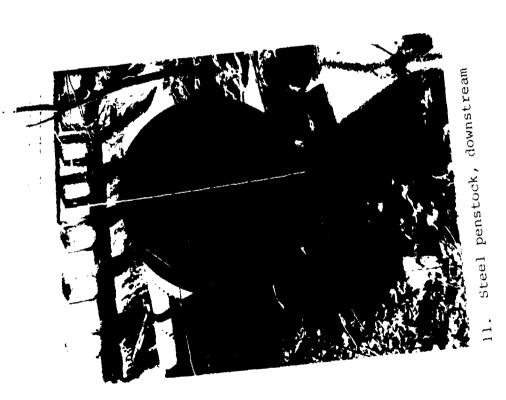


 Deteriorated stoplog supports along upstream side of spillway



10. Spalling concrete at right headwall, upstream





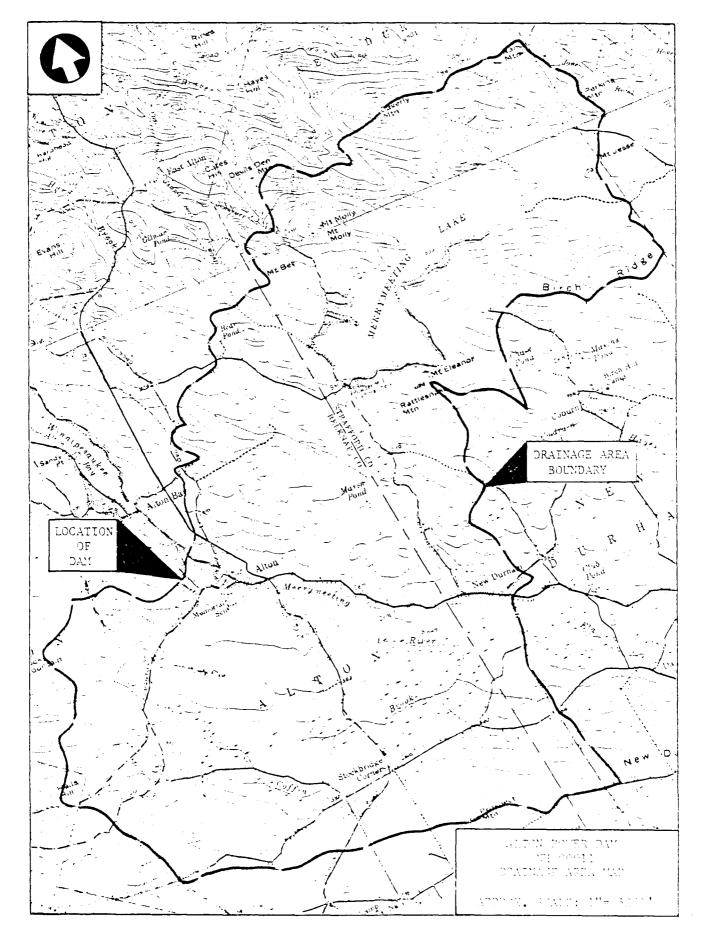


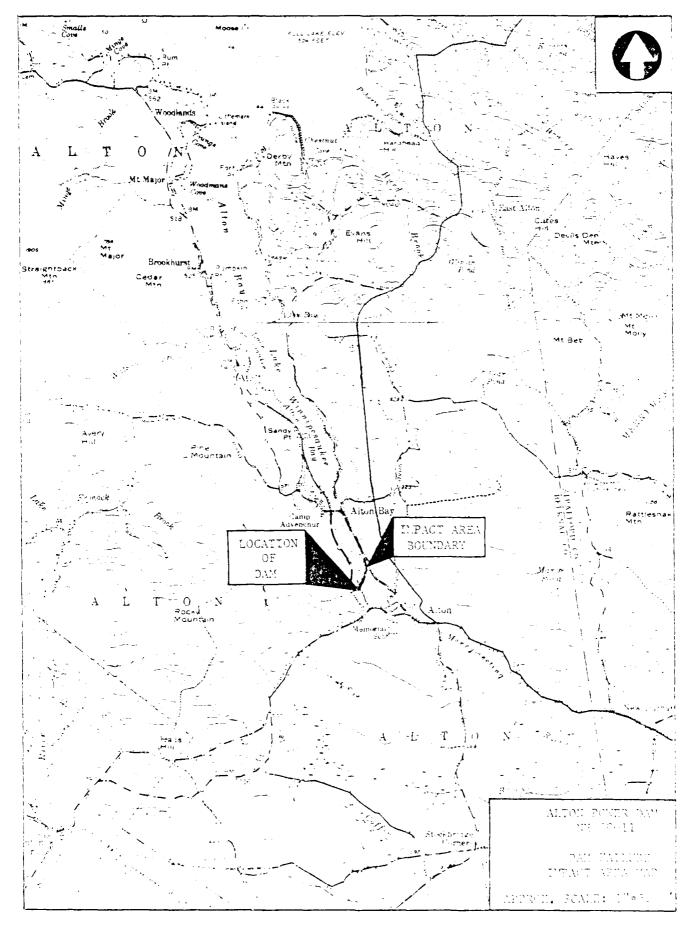
13. Right headwall, gate house and outlet works intake, upstream

3-3

APPENDIX D - HYDROLOGIC AND HYDRAULIC COMPUTATIONS

| MAPS | Page No. |
|--|-------------------|
| Drainage Area Map Dam Failure Impact Area Map | D-1 D-2 |
| COMPUTATIONS | |
| Elevations, Surface Areas, Storage Capacities and | D-3 |
| Size Classification Hazard Classification, Test Flood Determination and | D-4 |
| Stage-Discharge Relationships Stage-Discharge and Storage-Elevation Curves Surcharge-Storage Routing Tailwater Analysis and Outlet Works | D-5 D-6 D-7 |
| Dam Failure Analysis | D-8 |





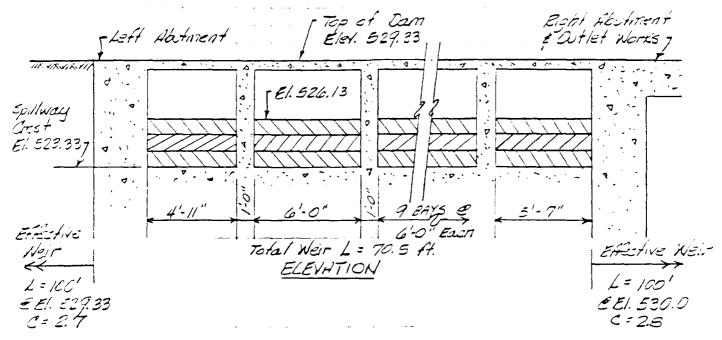
| mental Engineers | PROJECT DAM | 1 INSP. | DATE CHECKED 11-23-79 | _ COMPUTED BYUED DATE///26 |
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| | 964 | acres | | |
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| | Spillwau C | rest: 12 ar.x | 10' = 120 acff | |
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| | | + 1560c. x | 4' = 624 ac ff. | |
| | | | 1,116 ac. Al. | |
| 77 | o of Dans | : (12+37)/2 * | 6 +120 = 267 | |
| | | + (62+75)/2 x | 6 + 120 = 267 6 + 372 = 763 7 x6 + 624 = 3,705 4,758 a | |
| | , , , , , , , , , , , , , , , , , , , | (156+872)/2 | x6+624 = 3,708 | • |
| | | | 4,758 2 | soft. |
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| 5/2 | ZE CLASSI | FICATION | | |
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| Environmental Engineers | PROJECT_ | DAM IN | SP | DATE CHECK | ED //-28-79 | DATE | 11/27/79 |
| Boston, Mass. | DETAIL_ | ALTON POV | UER | CHECKED | BY be A | PAGE NO | 2 |
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| | basin | and flo | et in | the low | er basin. 7 | he ubber | |
| | basin | , approx. | 11 50.1 | ni., 15 | fributary to | Mest inger | hino |
| | Lake | which ! | 1035 a. | surface . | tributary to area of 112 | o asks e | or |
| | 16 % | of it's | fributa | ry dizino | age was. | The low | er |
| | portio | 1. OF A | le war | fershed . | nge disa. has subst | antial | |
| | marsh | e areas | along | Coffin | Brook whi | ich is | |
| | | ry to A | | | | | |
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| | Aributai | y to ME | rymezti | ra Lake | . 15 . 25En hi | allo contr | cled |
| | and . | that the | ceak | inflow | to, the Al | ton Rue | |
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CAMP DRESSER & McKEE CLIENT HALEY I ALDRICH JOB NO 56-10-RT-Z COMPUTED BY ED DATE CHECKED 1/-28-79 DATE 7-27-79

Boston, Mass. DETAIL ALTON DAM CHECKED BY Joe A. PAGE NO. 4



| ELEY. | SPILLWAY | SPILLWAY Q (cfs) | LEFT BANK Q (Cfs) | RKHT BANK Q (cfs | TOTAL Q (cfs) | _ |
|--|---|---------------------|--|---------------------------------|------------------------------------|---|
| 526.13 527.0 528.0 529.33 530.0 531.0 532.0 534.0 | 3.38 × 0.98 3.54 × 0.97 3.65 × 0.96 3.80 × 0.95 2.87 × 0.94 4.0 × 0.94 4.0 × 0.94 | 3 700 4,770 | - 0 150 580 1160 1900 2720 | 0 280 190 1450 2240 | 2,090 3,620 5,670 6,120;7 | 1730 chs wijs Shaplogs 1420 chs wijo spociogs, spilway chig |

SURCHARGE - STORAGE ROUTING WITH STOPLOGS IN PLACE

Test Flood Inflow = 12,900 ofs = Qp, Surcharge Height to pass Qp, = 534.8

570R, = 5,300 ac.ft \(\frac{12^n}{12}\) frac{1}{12} = 4.23 inches
23.5 \(\frac{1}{2}\) mi. \(\chi \text{640 ac.53 ac.} \)

Eirchaige Height to pass Gp2 = E33.7

ETOR 2 = 4600 20-F4. x 12 / F4

23.5 59.011.x 640 00/59.011.

CAMP DRESSER & McKEE CLIENT HALEY! ALDRICH JOB NO. 50-10-RT-2 COMPUTED BY SED

Environmental Engineers PROJECT THM THSP DATE CHECKED 11-28-79 DATE 11-27-79

Boston, Mass. DETAIL ALTON ROWER CHECKED BY See A. PAGE NO 5

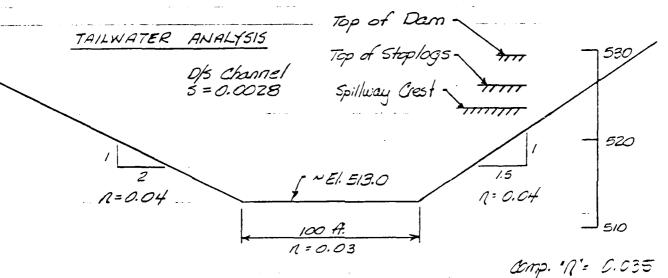
STOR_A =
$$\frac{3.67 + 4.23}{2}$$
 = 3.95 inches

 $A_{P3} = 12,900 (1-3.95/19) = 10,220 cfs, say 10,200 cfs$

TEST FLOOD INFLOW = 12,900 cfs

ROUTED TEST FLOOD OUTFLOW = 10,200 cfs

TEST FLOOD ELEVATION = 533.8



CHANNEL X-SECT. AT TOE OF DAM

| W.S. ELEV. | AREA (59. ft.) | W. P. (ff.) | HYD. RAD. | (cfs) |
|------------|-------------------|----------------|--------------|--------|
| 5/8.0 | 544 | 120 | 4.53 | 3355 |
| 520.0 | 786 | 128 | 6.14 | 5940 |
| 522.0 | 1042 | 134 | 7.66 | 9 120 |
| 522.5 | 1108 | 138 | 8.03 | 16,000 |

Tailwater @ T.F. = El. 522.5 L spillway crest elev.

OUTLET WORKS

Cutlet works consists of a 6.0" sq. wooden gate followed by a 6'x 5' Reducer and a length or 5'4 Stil pipe Gate Inv. Elev. 516.74

apacify & Top of stoplogs = 0.85 x 19.6 (34.4 x 9.4) = 400 :45

CAND DESSER & MCKEE CLIENT HHLET & ALDRICH JOB NO GOL-10-RT-Z COMPUTED BY JED

Enum the indigeneers PROJECT DAM INSP. DATE CHECKED 4-9-80 DATE 4/7/80

Jeton, Wass. DETAIL ALTON DAM CHECKED BY JOE A PAGE NO 50

SURCHARGE - STORAGE ROUTING WITH STOPLOGS REMOVED

| W.S. ELEV. | SPILLWAY Q (cfs) | OVERZAMK Q (cfs) | TOTAL Q (cfs) | ESTIMATED SURCH, STOR. |
|----------------------|---------------------|---------------------|------------------|---------------------------|
| 523,33 | 0 | - | 0 | 0 |
| 525.00 527.00 | 550 1780 | - | 550 1780 | |
| 529.33 530.00 | 3,730 4,310 | 0 150 | 3,730 | 3642 |
| 531.00 532.00 | 5,320 | 860 1970 | 6,180 8,360 | |
| 533.00 | 7,420 | 3350 4960 | 10,770 | 6,477 |

Test Flood Inflow = 12,900 cfs = 9, Eurcharge Ht. to pass Q_P , = 533.8 STOR, = $\frac{6.350 \text{ ac} \cdot \text{ft.} \times 12^{\circ}/\text{ft.}}{23.5 \text{ sp.mi.} \times 640 \text{ ac}/\text{sp.mi.}} = 5.07''$ $Q_{P2} = Q_{P1} \left(1 - \text{STOR}/19'' \right) = 12,900 \left(1 - 5.07/19 \right) = 9,460 \text{ cfs}$ Eurcharge Ht. to pass $Q_{P2} = 532.5$ $STOR_2 = \frac{5.550 \times 12}{23.5 \times 640} = 4.43''$ $STOR_4 = \left(4.43 + 5.07 \right) / 2 = 4.75''$ $Q_{P3} = 12,900 \left(1 - 4.75/19 \right) = 9,675 \text{ cfs}$, say 9,700 cfs TEST FLOOD INFLOW = 12,900 cfs

TEST FLOOD ELEVATION: 532.6

Boston, Mass.

DETAIL DAM FAILURE

JOB NO. Ed-10-12T- 2 COMPUTED BY DATE CHECKED 11-28-79

CHECKED BY Joe A.

DAM FHILURE ANALYSIS

Spilluray discharge prior to failure w/ pend W.S. at top of dan; assume 2.8 A. of stoplags inplace

Crest Length = 10 bays @ 6ft ea + 12 5.7" + 1@ 4'-11" = 70.5 ft.

head = 3.2 ft.
"C" = 3.65 x 0.96 = 3.5

: Qs = (3.5)(70.5)(3.2) 1.5 = 1,410 cfs

Length of dam, including right and left embackness Length of Maximum failure = 190 x 40% = 76 ft. Length of Left embankment = 65 ft., .: assume ill=65 ti

: Of = 8/27 TA Wb Yo -= 8/27 * (32.2) * 65 * (16) 1.5 = 7,000 cfs

Qp = Gs + Qf = 1,410 + 7,000 = 8,410 cfs

Merrymeeting River flows approx. 1 mi. from the Winnipesaukee.

Existing development, downstream it dem which would be impacted by a dam failure saists

- 1. Road kading from dan to Alten Bry is 4 to 6 ft. above normal, river stage between the dam and Rt. 11 with three homes baying sill elel. ~ 6 to 10 ft. acove normal over W.S.
- 2. Sill elev. 8 ft. above permal river of house located at junction of Rt. 11
- 3. New development located ~ 1500 ft 1/5

 It filten by consists of 5 homes on the
 right bank and 4 homes on lett bank
 with sill clev. from 2 to 10 ft. above
 normal river. Development not shown on Good sheet.

Bos in Mash

CAMP DRESSER & MICKEE CLIENT 44 FVE HATPOH Environmental Son Lers PROJECT DAM TNSP DETAIL DAM FRIZEE

DATE CHECKED 11-28-79 CHECKED BY Joe A

JOB NO EGY CALTED SOMELTED BY E

4. At the continuence of the river with Alton be THETE DRE NID HOMES, I METEL, INTIL DETE merica sil lossifica sons the banks of the MIVET.

depth and magnifude of Eleunetream TExting.

At Area =1, no flooding of the roudway or names would be expected orior to failure. Following failure, the road would be thought for water and 2 homes would have when rett avove sill elev.

At Area #2, the river store would be about , equal to, the sill, elev. of the exist house fellowing failure

At Area #3, agorex 3 to 4 have woold experience some theoding prior to tecture.
Following failure, wither deptiles would
included by about 5 to 6 teet, thousing
an additional 5 to 6 honors.

HA HARE # 4. depth of flooding world inside. Manuege.

1. Potential 1955 of like is arest and Hasses Classification is +164

APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

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| VENTORY OF DAMS IN THE UNITED STATES SUPPLEMENTARY DATA | (<u>Å</u> - <u>§</u>) | STATE NUMBER | 35) 34 37 36 39 46 47 42 44 44 44 44 44 44 | (<u>8</u> <u>9</u>) | | (9:7) (6:3) (6:3) | 1451 RETIRED FOHMER OFF YEAR 14 53 17 7 7 7 7 7 7 7 7 |
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